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A. & M. College Apiary.

Fred W. Mally, and
Wilmon Newell.

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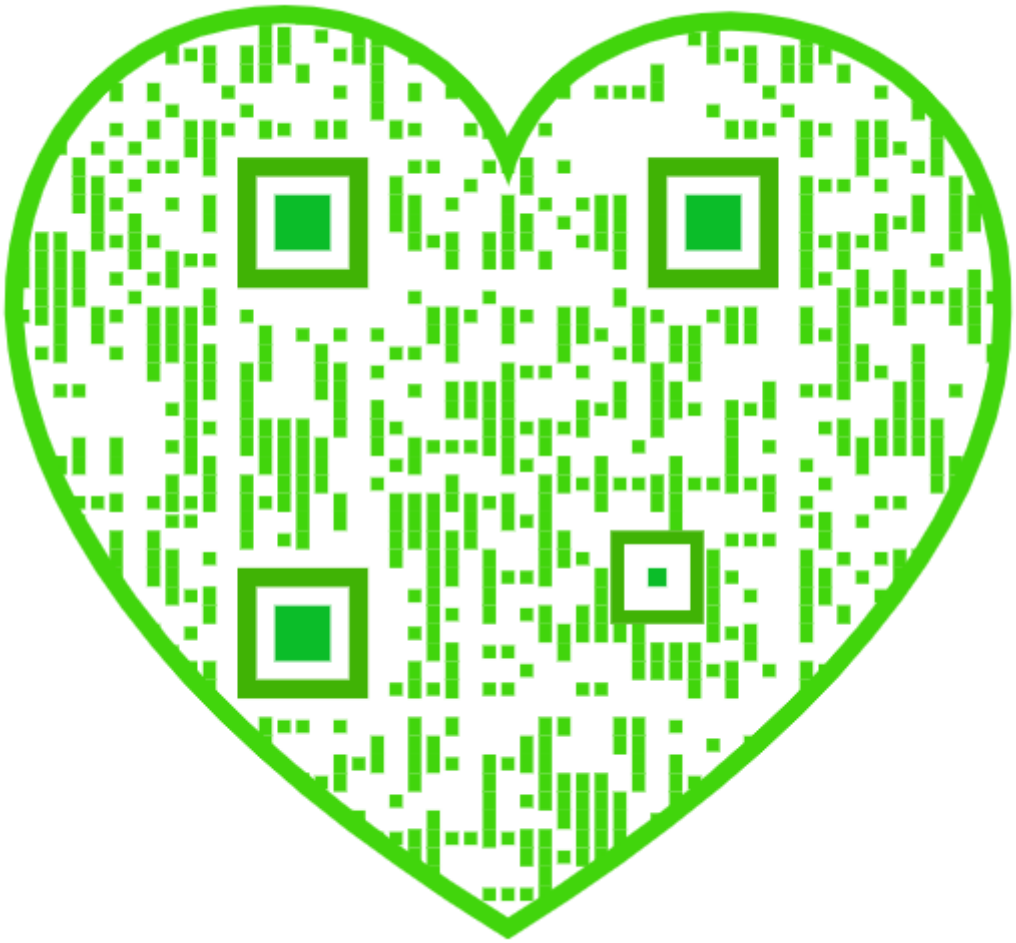
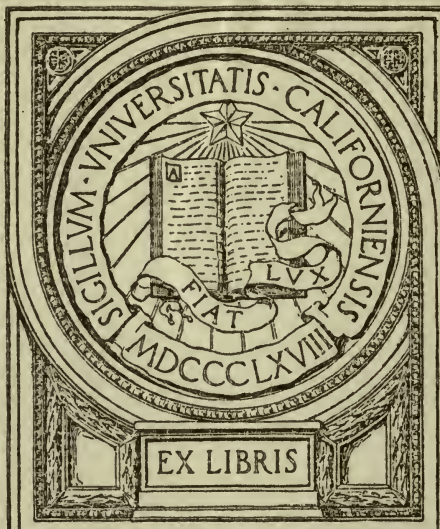


IN MEMORIAM
Edward J. Wickson



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REPORT

ON THE

A. & M. COLLEGE APIARY.

TOGETHER WITH PRACTICAL SUGGESTIONS IN MODERN METHODS OF BEE KEEPING AS APPLIED TO TEXAS CONDITIONS.

BY

FRED. W. MALLY,
PROFESSOR OF ENTOMOLOGY,

AND

WILMON NEWELL,
ASSISTANT.

AUTHORIZED BY THE TWENTY-SEVENTH LEGISLATURE.

AUSTIN, TEXAS:
VON BOECKMANN, SCHUTZE & CO., STATE PRINTERS.
1902.

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PLATE I.—EXPERIMENTAL APIARY AT AGRICULTURAL AND MECHANICAL COLLEGE

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E. J. Wickson
MAIN LIBRARY-AGRICULTURE DEPT.

LETTERS OF SUBMITTAL.

Dr. David F. Houston, President, College Station, Texas.

DEAR SIR: Herewith I beg to submit a report upon the work accomplished with the Apiary at the College the past six months, since the establishment of the same this season. The year thus far has been a most unfavorable one for surplus honey production and the colonies have been brought in and established and bred up to a strong working force under the greatest difficulties.

Mr. Wilmon Newell was selected as Assistant Entomologist in February and was given the immediate charge of the Apiary and its care and development preparatory to experimental work. Much preliminary work has been done under my direction and the basis for much valuable work in the future prepared. Some important suggestions have already developed from the work upon honey plants and the studies made concerning them the past season. Then, too, it has been found that there is a pressing demand for some kind of ready reference and guide for the farmers, truck growers, and fruit growers, who have a few colonies, but who are not familiar with up-to-date methods. For all of these reasons I have asked Mr. Newell to prepare a complete report covering many of the serious difficulties encountered. This will be of great value to the rural bee keepers of the State. His report has been prepared with great care, and I take pleasure in submitting the same herewith and recommending it for publication as a portion of my annual report.

Respectfully submitted,

FRED. W. MALLY,
Professor of Entomology,
Agricultural and Mechanical College.

Submitted August 30, 1902.

Prof. Fred. W. Mally, Entomologist, College Station, Texas.

DEAR SIR: In compliance with your instructions, I beg to submit herewith a report upon the Experimental Apiary, located at the Agricultural and Mechanical College, which was created by act of the Twenty-seventh Legislature.

The first part of this report deals particularly with the Experrmental Apiary, the expenditures made in establishing same, and the work accom-

plished up to September 1, 1902. As directed by you, this report contains also a summary of the studies made relative to the honey producing flora of Central Texas, and experiments conducted with cultivated honey plants, and the results of same. A synopsis of experiments under way, and contemplated for future work, is also given.

The second part of this report consists of notes and practical suggestions upon modern and successful methods of bee keeping, for the guidance of farmers, fruit growers, and others who are interested in the industry of bee keeping in a small way, and as a guide for those desiring to enter this industry.

Respectfully submitted,

WILMON NEWELL,
Assistant Entomologist.

August 30, 1902.

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ACKNOWLEDGMENT.

The Department of Entomology wishes to acknowledge the following favors and assistance given in the establishment of the Experimental Apiary at the College, as well as in the preparation of the appended bulletin:

A. I. Root Co., Medina, Ohio, special discounts and prices on apparatus necessary in establishing the Apiary, as well as the loan of the greater number of cuts used in this publication.

W. M. Crook, Cresson, Texas, one colony of bees.

Hyde Bee Co., Floresville, Texas, one tested queen.

W. O. Victor, Wharton, Texas, two tested queens.

J. W. Ross, Velasco; T. J. Adams, Velasco; G. F. Davidson, Floresville; W. H. Laws, Beeville; Louis H. Scholl, Hunter; J. K. Hill, Uvalde; and many other prominent bee keepers throughout the State, have rendered valuable assistance in the work of compiling data relative to the bee and honey statistics of the State, as well as in the study of the native honey-producing flora of their localities.

Throughout this report, quotations have been made from various authorities, credit for which is given as these quotations appear in the text.

REPORT UPON THE EXPERIMENTAL APIARY AT THE AGRICULTURAL AND MECHANICAL COLLEGE.

FRED. W. MALLY AND WILMON NEWELL.

The Twenty-seventh Legislature of the State of Texas appropriated the sum of $750 for the establishment and maintenance of an experimental apiary at the Agricultural and Mechanical College, for the purpose of giving instruction in bee culture to the students of that institution, and for investigating such problems of bee keeping in Texas as would benefit those engaged in this industry. The task of establishing and maintaining this apiary was assigned to the Department of Entomology. Of the $750, $500 was appropriated for use during the year ending September 1, 1902. Owing to inability to secure competent assistance for this department, the establishment of the Experimental Apiary was not begun until March 1, 1902. Even then, owing to a rush of orders at the factories, it was impossible to secure the necessary supplies for this work until about May 10th. The forepart of the season of 1902 was, in the vicinity of the College, exceedingly dry, and hence unfavorable for the best success in the breeding and care of the bees, as well as making it impossible to get the best results in the experimental work with cultivated honey plants. In all its phases, the work has been subject to unavoidable and vexatious delays.

One of the first things done was to enclose a tract of land of about ten acres for the purpose of securing a proper place for the honey house and apiary, as well as for sufficient ground for carrying on experiments with honey-producing plants. The tract enclosed has running through it a fine wooded ravine, and also encloses a natural grove, making a most ideal location for an apiary. In addition to this, about six acres of ground, which were formerly in pasture, have been broken and put in condition for experimental work.

The sum of $500 available for the first year's work has been expended as follows:

Bees and queens	$ 33 88
Freight and express	46 76
Bee hives and apparatus	186 18
Books and technical magazines	11 95
Seed of honey-producing plants	6 31
Lumber and fixtures for honey house	149 02
Tools	53 25
Incidental expenses	12 65
Total	$500 00

These expenditures were for the raw material in the shape of lumber for the honey house, hives and supplies knocked down, etc. The honey house, including a well-equipped workshop, has been built, painted and thoroughly equipped, and all hives, supers, and other apparatus put together and painted ready for instant use. In addition to this the bees purchased, consisting of six colonies in all, together with one colony kindly donated by Mr. W. M. Crook, of Cresson, Texas, have been increased to twenty-one colonies, and a number of pure Italian queens for these new colonies have been reared. It will be seen that this would result in a marked increase in the valuation. As a matter of fact, the present inventory (September 1, 1902) shows a cash valuation of $729.10, or an increase in value of $229.10 between March 1 and September 1, 1902.

The outfit of supplies purchased includes nearly all patterns or models of hives, supers, frames, and sections of standard manufacture which are in common use among bee keepers. These various models are being carefully tested to determine their relative value under Texas conditions, for such qualities as protection from heat, honey-storing facilities, etc.

As rapidly as possible the bees in this apiary are being bred to the highest possible standard of excellence, both by purchase and by importation of the best three-banded Italian queens, and by careful selection of drone mothers when breeding, and by carefully selecting only the best queens in the yard for breeding purposes. Of each colony a careful record is kept which shows the qualities of that colony relative to honey-gathering ability, productiveness, vitality, docility, purity, comb-building ability, and ability to withstand drouth and unfavorable conditions.

At the annual meeting of the Texas Bee Keepers' Association, held at the Agricultural and Mechanical College in conjunction with the Farmers' Congress July 16 and 17, 1902, by request of the entomologist, the Association appointed a special committee to investigate thoroughly this experimental apiary. The Committee reported as follows:

"Your committee has investigated the apiary upon the College grounds and has found the bees in good and healthy condition, a very neat honey house and in it all necessary implements for the apiary. Our opinion is that the small sum of money at the command of Prof. Mally was invested in a very proper way for the purpose of creating the apiary, the object of which is to serve as a medium of instruction to the students of the Agricultural and Mechanical College. Especially were we pleased with the orderly and systematic arrangement of the whole. We hereby recommend that more money be expended upon this apiary, so that it will contain at least fifty colonies and the necessary implements, as we think the present number is not sufficient for the proper carrying on of experiments.

(Signed) "L. STACHELHAUSEN,
"FRANK L. ATEN,
"MRS. C. R. WEST,
"Committee."

It is proposed, during the coming year, to make a study of the different strains or races of bees. In Texas at the present time there are in use by the various bee keepers the races known, respectively, as Three-banded Italians, Golden Italians, Cyprians, Carniolans, Holy Lands, and the

common Black or German bee. It is proposed to determine as nearly as possible the comparative length of life of the bees in these different races. This will be of immense value, especially if it be shown that any one race of bees be longer lived than another. Other things being equal, that race having the longest life will be best enabled to withstand the severe drouths which at times afflict many of the very best honey-producing sections of the State. The main drawback to these honey-producing sections lies in the fact that during a drouth the colonies become weakened. When the honey flow again starts, if the bees have not perished in the meantime, a considerable time is required for them to breed up to a profitable working strength, during which time much honey remains in the flowers ungathered and constitutes a heavy loss. To overcome this is one of the problems to be solved, and it is proposed by experiment to determine the race or races of bees best adapted to such conditions. In addition to this an attempt is being made to find and cultivate some honey plant, which during such dry seasons will yield sufficient honey to keep up the strength of the colonies until the following honey flow. With this object in view, one of the first lines of investigation inaugurated by this department was that of making a close and critical study of the native honey plants of Texas. To complete such a study will, of course, require several years, but the work is now being carried on as rapidly as the time and money at command will permit. At the outset, realizing the importance of finding some drouth-resistant plant worthy of cultivation for honey, varieties amounting to forty different kinds and species were sown each month during the season, and their adaptability to Texas climates and soils, as well as their honey-producing qualities, carefully noted. The greater number of these were found unable to withstand the drouth, and therefore not adapted to the purpose. Those which were partial or total failures were as follows: *Astragalus sinicus,* American varieties of buckwheat, Alsike, Sweet, Crimson, Japan, Mammoth Red, Red, Sand, Suckling, and White Clovers, Yellow Trefoil, Japanese Delchos, *Euphorbia marginata, E. Heterophylla, Asclepias tuberosa,* German Rape, English Rape, Soja Bean, Velvet Bean, *Vicia sativa* and *Vica villosa.* Australian Salt Bush was found to grow well and to withstand the drouth, but it did not, under the prevailing conditions, yield honey. It would doubtless form a valuable plant for grazing and for forage, especially in those sections where the soils contain a small or medium amount of alkali. Of all plants tested, Japanese buckwheat gave the best results. With medium or even poor soil, and a very small amount of moisture, this plant can be depended upon to begin blooming thirty days after planting and will continue to bloom for thirty days, at the end of which time the seed is ready to gather. It will be seen that it is a very easy matter to regulate the time of sowing, so that a honey flow will be had from this plant at the beginning of a dearth of natural forage for the bees. In addition to its value as a honey producer, the seed of this plant is made into a flour which produces, among other things, fine cakes, highly esteemed in the buckwheat regions of the North. Japanese buckwheat thrives best when drilled in rows about three feet apart, and cultivated during growth. The seed brings from $1.00 to $1.50 per bushel. In case seed is not desired the buckwheat can be cut and cured as is other hay, and is found to make valuable feed for farm animals. If grown more extensively there is no doubt that such hay would bring a good price in

the open markets. Continued experiments with this plant showed that it is possible for the season to become sufficiently dry during August to retard its growth and prevent its making seed. It is, however, as drouth resistant as any of our cultivated crops, cotton not excepted. Three varieties of cowpeas, i. e., the Wonderful, Clay, and Speckled, have been tested. The Speckled cowpea gave the best results. When the native honey plants had entirely ceased yielding nectar the bees continued to work heavily upon the cowpeas and secured ample honey therefrom to continue brood rearing, despite the fact that comparatively only a small acreage of cowpeas was available. The value of the cowpea as a forage plant and soil renovator is too well known to need discussion here. It has been conclusively demonstrated by our most progressive farmers that the cowpea is one of our most valuable farm crops. Its honey yield, therefore, is an absolute gain. The clovers, as above stated, were not found able to flourish under the conditions of soil and drouth existing in Central Texas. By way of explanation, however, it may be said that this department has thus far tested alfalfa only on the upland soils of the "timber belt." On such soils alfalfa was found to grow sparingly but not luxuriantly enough for either forage or honey. On irrigated lands its value both for forage and honey is undoubted. On rich bottom lands, such as prevail along the Brazos river, it is found to grow well, but its honey-producing qualities under these conditions have not as yet been tested. Giant Beggarweed (*Desmodium tortuosum*) was found to grow well, but did not yield honey as was expected. Black Mustard, Mignonette and Borage gave good results. With the varieties which have grown favorably, still further experimental work will be done. About thirty additional honey plants, as yet not cultivated in Texas, have been secured from the North and East, and will also be tested. After careful tests have been made at the College with these various honey-producing plants, seeds of those found to be worthy of cultivation will be distributed free to bee keepers in different sections of the State, to be tested by them in the soils and conditions prevailing in their localities.

It seems likely that if a perfect drouth-resistant honey plant is to be had, it will eventually be found in some of the arid portions of the country, such as Western Texas, Mexico, or Arizona. For a long time it has been the ambition of bee keepers everywhere to secure some plant which could be profitably cultivated for surplus honey. In Southwest Texas are many plants, such as Guajilla and Cat-claw, which at times give an enormous yield of honey. Therefore, an investigation of such plants with a view to testing them under cultivation has been taken up.

In the manipulation of hives and colonies, much has been learned the past few years, which has enabled the progressive bee keeper to increase and often double his honey production. This manipulation is as yet only partially developed and further studies along this line with a view to increasing present honey yields in Texas is being taken up.

Queen rearing, a more specialized branch of bee keeping, is still an industry in its infancy, and so far as time will permit, studies along this line and improvements upon present methods are being planned.

Texas excels every other State in her honey production, yet to one who has studied the situation and the vast territory and vegetation of this State, it is evident that as yet Texas does not produce one-tenth the honey which it might through proper management and further devel-

opment. A careful estimate shows also that at least 90 per cent. of the bee keepers of the State are not practicing up-to-date or modern methods of bee keeping, thereby getting less than one-half of the possible amount of honey from the colonies already on hand.

Expert bee keepers find it very difficult to secure competent labor in their apiaries. For the purpose of supplying this want, and for educating the bee keepers and farmers in general, a complete set of apparatus has been provided at the College for giving instruction, not only to students of the institution, but to such bee keepers and farmers at large as may desire to acquaint themselves with modern methods or increase their present working knowledge along apicultural lines.

Some of the possibilities of honey production in Texas may be better understood from a study of Uvalde county, which is practically the only county in which bee keeping has been developed to anything like its possible extent. In this country and immediately adjoining, according to Mr. J. K. Hill, of Uvalde, there are located about fifteen thousand colonies of bees, representing, with apparatus and fixtures used in their care, an investment of at least $120,000. In average seasons, under competent management, these colonies yield from 100 to 220 pounds of honey each. Aside from the honey sold and consumed locally, there is shipped from Uvalde annually an average of 546,000 pounds, representing from $54,000 to $60,000. There are in Southwest Texas at least thirty counties that would, if properly developed, equal or exceed this yield. In addition to this there is valuable honey-producing territory along the Colorado, Guadalupe, Brazos, Trinity and Sabine rivers that is as yet almost totally unoccupied. The entire East Texas territory, some parts of North Texas, as also the timber belts, are promising for future development.

Nor should we be content with the money value of the wax and honey produced in the State, or that money represents the value of bee culture to the commonwealth at large. He who would raise fruits of any description must depend upon insects for pollenation of the fruit bloom. While there are many native insects that take part in this work, there are none which do it as rapidly or effectually as the honey bee. It has long since been demonstrated that it is to the interest of the fruit grower to make conditions as favorable as possible for the bees and bee keepers in his locality. The service rendered to the fruit industry, and the greatly increased fruit production resulting therefrom cannot be estimated in dollars and cents. The idea, prevalent in some localities, that bees will injure growing or ripening fruits, is entirely without foundation. As a matter of fact, the mouth parts and honey-gathering apparatus of the bee are of such a nature that puncturing or biting the skin of any fruit, no matter how tender, is an absolute impossibility. When fruit has been damaged from any cause, the bees will frequently be seen sipping up the juice that exudes, and this has doubtless given origin to the popular fallacy mentioned above. In Central Texas the growing of alfalfa is being recognized as an important industry, and in the development of the State it is certain that many localities peculiarly adapted to this plant will be devoted largely or exclusively to its culture. Alfalfa cannot be raised without seed, and alfalfa seed cannot be produced unless the honey bee is present to fertilize the alfalfa blossoms. Thus we see that what in the future promises to be a most important and extensive industry, as

it is already in parts of Colorado and other Western States, is dependent upon the bee and the bee keeper. In considering the value of the bee keeping industry to the commercial interests of the State, these points should not be overlooked.

In short, this industry in Texas is comparatively in its infancy, and the amount of popular educating which should be done, and investigations which should be made, are practically unlimited. It is also assured that careful investigation along bee keeping lines will yield as great returns as any other line of experimental work in agriculture.

In the previous pages, mention has been made of the large number of people in the State who are at present not familiar with modern bee keeping methods. It is for the purpose of making a few practical suggestions to such, that the author begs to append hereto a brief treatise on bee keeping. No attempt has been made to make this a text-book, or even a bulletin or manual for the experienced bee keeper or specialist. It is rather for the small bee keeper or the farmer with a few colonies—in box hives perhaps—who is anxious for information regarding his little workers, that these paragraphs are appended.

BEE KEEPING.

A BRIEF DESCRIPTION OF THE PRINCIPAL METHODS AND APPARATUS USED IN SUCCESSFUL BEE CULTURE.

INTRODUCTION.

As stated in the above report on the Experimental Apiary at the Agricultural and Mechanical College, there is a large call for reliable information from farmers, fruit growers, and others who are keeping bees in a small way, also from those who have a desire to enter this interesting and usually profitable industry. As no publication has heretofore been available for distribution in response to this call for information on the subject, it is here proposed to give a brief description of the principal tools, hives, and other apparatus used in modern bee keeping, and a brief discussion of their uses.

In almost any locality of the State may be seen in many of the door-yards a few "bee-gums" or box hives, as they are popularly called. These are no more nor less than upright boxes, about twelve inches square and from one to three feet in height. In each of these will be found domiciled a colony of bees, with the earth for a floor, and a few auger holes for doors. There is no way of examining them or ascertaining the condition of the colony without first making a determined attack with hammer and cold chisel in order to remove the top of the box-hive. This done, a mass of combs, usually crooked, irregular and promiscuously attached to the walls, greets the eye. The brood chamber, in which will be found the queen, the young bees or larvæ, and in which the household work of the hive is carried on, is in the lowest part of the hive. To reach this, one must cut out the combs in the upper part, which results in the honey flowing down over the bees below, and frequently in severe mashing and breaking of the brood combs themselves. Once opened, the combs cannot be replaced and the inhabitants must right matters as best they can, often requiring for them weeks or even months of time and labor. In many cases the result of "robbing," as this process is called, is to so weaken the colony that the wax-moth gains access to the hive and deposits eggs, which later hatch into "worms," or larvæ, that destroy comb and honey so rapidly that the colony in a short time dies out. The owner has no means of assisting the bees in their battle against the "worms" and the result is that the latter win the battle. In a southern climate, such as prevails in Texas, the wax-moth is peculiarly abundant, and its growth and reproduction is rapid. In many localities its ravages have been so severe that it has destroyed more than the natural increase of the bees resulting from swarming. The author recently asked a bee keeper how many colonies he had. Reply: "Seventeen in box hives. * * * Had sixteen three years ago. * * * Worms killed them out. * * * Think I have done well." The natural increase from sixteen colonies in three years

would under average conditions amount to no less than 128 colonies at the lowest calculation. Here, then, is a loss of 111 colonies due to the wax-moth, or a loss of 693 per cent., as compared to the original sixteen colonies. The use of modern bee keeping methods and frame hives disposes of the wax-moth. Further argument in favor of the frame hive, or "patent gum," and in favor of intelligent management is unnecessary. The fact that any man or woman of average intelligence can with a little study of literature easily available, and with a small expenditure of money, install the proper apparatus and conduct bee keeping in a profitable way, is assurance that there is no possible excuse for the continued existence of the box hive. With the latter the farmer considers himself lucky if he gets an average of fifteen pounds of honey per year from each colony. With frame hives the experienced and enlightened bee keeper considers himself *unlucky* if he does not get an average of at least forty pounds per colony. Yields of 120 pounds per colony on an average are not unusual in certain localities, and individual colonies have produced as high as 600 pounds in a single year. It will thus be seen that with antiquated methods the best results cannot be obtained. With bees as with other farm stock, intelligent management and proper accommodations must be provided in order to secure profitable returns. This does not necessarily mean that a large amount of capital must be invested. Ten dollars properly expended will provide everything necessary for one to begin intelligent bee keeping with the best of hives and supplies. Nor is a previous knowledge of the industry necessary for the beginner. The great majority of the successful bee keepers of today were without instruction of any kind at the outset and by study of such literature as they could obtain, and more especially by a careful study of the bees themselves and their habits, they have met with success and profit.

Every farmer should have at least a few colonies of bees. Almost any locality in the State of Texas will support a small number of colonies, even though that locality may not be adapted to the industry on an extensive scale. Many towns and cities afford a profitable location for a few colonies. Only a small amount of room is needed for the hives, and the cultivated and ornamental plants, as well as the flower gardens found in the typical town or city, afford a no inconsiderable source of honey. The keeping of bees also affords a pleasant recreation for the business or professional man. The taste for honey and its value as a table delicacy are known to all. As a sweet its purity cannot be approached by any sugar or syrup. Honey is composed for the most part of two sugars, levulose and dextrose, which are considered as healthy as any other form of sweet. The fact that honey comes direct from the bees, without being exposed to the contamination incident to factories, transportation, etc., shows its undoubted purity and cleanliness.

FOOD VALUE OF HONEY.

Relative to the healthfulness and food value of honey we take from a booklet entitled "Food Value of Honey," published by the A. I. Root Co., of Medina, Ohio, the following:

Dr. C. C. Miller says: "About sixty pounds of sugar on the average is annually consumed by every man, woman and child in the United States. It is only within the last generation that refined sugars have

become so low in price that they may be commonly used by the poorest families. Formerly honey was the principal sweet. It would be greatly for the health of the present generation if honey could be at least partially restored to its former place as a common article of diet. The almost universal craving for sweets of some kind shows a need of the system in that direction; but the excessive use of sugar brings in its train a long list of ills. Besides the various disorders of the alimentary canal, that dread scourge, Bright's disease, is credited with being one of the results of sugar eating."

Prof. Cook says: "There can be no doubt but that in eating honey our digestive machinery is saved work that it would have to perform if we ate cane sugar; and in case it is overworked and feeble, this may be just the respite that will save from a breakdown."

Mr. A. I. Root says: "Many people who cannot eat sugar without having unpleasant symptoms follow will find by careful test that they can eat good, well-ripened honey without any difficulty at all."

"Not only is honey the most wholesome of all sweets, but it is the most delicious. No more tempting dish can grace the table at the most lavish banquet; and yet its cost is so moderate that it may well find a place on the tables of the common people every day in the week. Often a prime article of extracted honey, equal to comb honey in every respect save appearance, can be obtained for half the price of butter or less. Butter is at its best only when fresh, while honey properly kept remains good indefinitely—no need to hurry it out of the way for fear it may become rancid."

Prof. Cook further says: "We all know how children long for candy. This longing voices a need, and is another evidence of the necessity of sugar in our diet. Children should be given all the honey at meal time that they will eat. It is safer; will largely do away with the inordinate longing for candy and other sweets; and in lessening the desire will doubtless diminish the amount of cane sugar eaten.

"Sugar is much used in hot drinks, as in coffee and tea. The substitution of a mild flavored honey in such cases may be a very profitable thing for the health. Indeed, it would be better for the health if the only hot drink were what is called in Germany 'honey-tea'—a cup of hot water with one or two tablespoonfuls of extracted honey."

In commercial bakeries, honey is the principal sweet used in the manufacture of the cookies, cakes, and biscuits commonly found on the market. Honey is practically the only sweet adapted to this purpose as it has the property of "keeping" the cakes moist and fresh for a comparatively long time. In domestic cooking honey can be used in a variety of ways, but the general substitution of honey for sugar in cooking is not to be recommended, as such attempts are sometimes disastrous. Properly used, however, many choice delicacies can be made with honey as the chief ingredient. In the booklet mentioned above are given no less than twenty-two recipes, all of which have been thoroughly tested and "found to be good."

PROFIT IN BEE KEEPING.

Where fruit is grown the yield is materially increased by the presence of honey bees to fertilize the blooms. Practical orchardists, realizing the importance of this, in many places furnish locations and facilities

rent free to bee keepers for locating bees in their orchards. In fruit growing localities it would be profitable from the orchardist's standpoint to keep bees, even were no surplus honey produced whatever.

Last, but by no means least, the question of commercial profit must be considered. In well-favored localities, bees properly managed will produce not less than sixty pounds of honey per colony each season, on an average. Considering this to be sold at the very low price of 6 cents per pound, the return will be $3.60. From this should be deducted, in order to secure a conservative estimate of the profit, say possibly as much as $1.10 for time expended, wear and tear on apparatus and hives and for capital invested in other apparatus. This leaves $2.50 as profit on the original amount invested in the colony, which should not exceed $5.00. It will be seen that this results in a net profit of 50 per cent. on the original investment. However, it must be kept in mind that figures are not always verified in actual practice. While under proper management and in favorable localities each colony may confidently be expected to yield an average profit of $2.50 per year, we would strongly emphasize the point that beginners at least should not "plunge" into the bee business. To be a specialist and a successful one requires good management, knowledge of economy in time and money, and a strict familiarity with the technical features of the industry. He who would become a successful bee keeper, and a bee keeper to the exclusion of other business interests, should begin with a few colonies—not to exceed five or ten—and carefully study them. As they increase, his knowledge and experience should keep pace, and it may be depended upon that in this advance the bees will increase in numbers fully as fast as the average man can increase in knowledge and experience. In other words, one should grow into the industry, rather than enter it suddenly, thereby preventing heavy losses and disappointments.

In making the above estimate the price of 6 cents per pound was given. This is below the average price, even where honey is sold in a wholesale way. When sold locally or retailed by the bee keeper himself honey of good flavor and color, well ripened, should bring not less than 10 cents per pound. In many cases bee keepers have built up their own trade in their own localities and in adjacent towns and cities; in many cases by offering only a superior article they are able to command a price of from 15 to 25 cents per pound.

RACES OF BEES.

For the benefit of those who may be undecided as to the best variety or race of bees to select, a brief discussion of these is here given.

Black, or German, Bees.—This is the bee that is most commonly found in box hives, bee trees and in many of the extensive apiaries in Texas. This bee originally came from Germany, being brought to America by the first settlers. Swarms escaping from their owners established themselves in hollow trees in the woods and have since been gradually increasing and spreading across the continent. Their numbers have been from time to time swollen by the additional swarms escaping from their owners, until now in some sections "bee trees" are comparatively abundant. Of late years many Italian bees have thus escaped to the woods, and it is not uncommon to find a bee tree containing hybrids and occasionally pure

Italians. Throughout, the bee has been the warning of the advance of civilization, invariably preceding the white settler by many miles. The appearance of a swarm of bees, in the early days, was considered by the Indians as an invariable sign of the white man's approach and signified to them the ultimate loss of their hunting grounds. The Black or German bee is too familiar to need any detailed description, suffice to say that in many cases colonies are found that equal in honey-producing ability any of the other races, and while, as a rule, their production does not average as high as that of the Italians, it is not advisable for the average bee keeper to dispose of individual colonies of black bees which make good or exceptional crops of honey.

Carniolans.—These bees at first sight appear much like the black bees, but close examination shows them to be more of a gray color and to have the rings of the abdomen a marked light gray. They are about the same size as the Blacks, the drones, if anything, being larger than those of the Blacks, and most decidedly larger than the Italian drones. The workers, and to a more marked extent the drones, have a gray pubescence or hairy covering over the thorax; and in the case of the drones covering also the under side of the abdomen, except on the median line. The Carniolans are noted for their docility and can be handled in the majority of cases without a veil or even without smoke. They sting but rarely and show a remarkably constant temperament. Mr. A. I. Root, however, reports the case of a colony which was fully as vindictive as the Cyprians. The same authority states that they gather but little propolis. Our personal observations bear out this fact, but there also seems to be a somewhat greater inclination to build brace combs, even when the frames are correctly spaced. This, however, is not a serious objection. In capping honey the Carniolans are superior to any other race, making thin caps of snowy whiteness. This is a decided point in their favor as it improves the marketable appearance of the product, especially in the case of section honey. In this respect the Carniolans are closely followed by the Blacks. The Carniolans are noted for their swarming propensities, and if this swarming impulse should prove to be uncontrollable, it would be a serious objection to them, as overswarming is most detrimental to the production of surplus honey. Mr. G. F. Davidson, of Floresville, Texas, however, reports that he can control swarming with this race as well as with other races by means of the "shook-swarm" method, which will be discussed later. The Carniolans have several times been tried in the North and East and have in most cases been abandoned as presenting no advantages over the Italians. They are at present being tested by several expert Texas bee keepers and the results thus far have been gratifying. While this or any other race may be found totally unadapted to Northern or Eastern conditions, the much different climate and conditions of honey flow prevailing in parts of our State may prove them to be of much value.

Cyprians.—In color and general appearance these much resemble Italians, but on the average are somewhat smaller and have a more glistening appearance, especially when exposed to direct sunlight. They are excellent honey gatherers, but have the drawback of a very excitable temperament. In fact, their distinguishing characteristics lie not in appearance, but in their actions. Always nervous and easily aroused to battle, they must be handled with but a minimum amount of smoke, and with even, almost slow, movements. The jarring of a frame against the hive, or

the dropping of a tool upon the frames, is often sufficient to send a veritable swarm out on the operator. Even without any apparent aggravation whatever they will sometimes fly out in this way in a sudden attack. In entering or leaving the hive the flight is quicker than that of the Italian, and is jerky and fidgety in its nature. In ordinary flight, also, the tone or hum of the wings seems to be of a higher pitch than that of other races. Being of a combative temperament, this race is especially capable of protecting itself against robbers, whether bees, human, or otherwise. Every bee as he alights at the entrance of the hive is at once pounced upon by the guards and critically examined before being allowed to proceed into the hive. The Cyprian is a prolific breeder, this being a marked advantage in some localities.

For the expert bee keeper who has nothing in view but the size of his honey crop, and in a climate like that of Southwest Texas, and for him who enjoys stings in abundance, the Cyprians will be found well adapted. The fact that they are not susceptible of rapid manipulation, and therefore require more time, is in the opinion of some a drawback that more than offsets their advantages as honey gatherers. Messrs. O. P. Hyde & Sons, of Floresville, Texas, who have experimented extensively with them, state that they have equaled and in many cases exceeded the yields given by the Italians. The Cyprians were first imported from the Isle of Cyprus and are regarded as being descended from the same stock as the Italians, but owing to their isolation have developed traits distinct from those exhibited by the Italians from the mainland.

Holy Land Bees.—The Holy Lands are a comparatively recent introduction into this country and have not as yet been extensively studied or tested. They come originally from the vicinity of Jerusalem and doubtless, judging from their appearance and habits, are also descended from the same original stock as the Italians and Cyprians. While, however, the development of the Cyprian branch has been towards a vindictive temperament, the development of the Holy Land has been towards a marked docility. Nor do the Holy Lands seem to be as closely related to the Italians as do the Cyprians, for they are smaller and darker in color, being in fact of almost an ashy appearance Especially when clustered on a comb is this ashy appearance very noticeable. According to Mr. W. H. Laws, of Beeville, Texas, who uses them almost exclusively in his honey apiaries, and who rears many hundreds of Holy Land queens annually, they are more prolific breeders than Italians and at the close of a honey flow will continue breeding for some time, gradually decreasing their operations in this direction. After finally suspending brood rearing for some time, they will again resume, even though no honey is to be had in the fields, rearing their larvæ entirely from honey stored the previous season. In localities where honey flows alternate with periods of absolute absence of forage for the bees, this point is of immense advantage as the strength of the colony is kept up and they are better prepared for work when the honey flow arrives. They can be handled easily with only a small amount of smoke and in many cases with none at all. Those of direct or recent importation show a more nervous disposition than those which have been bred in this country for several years.

Italians.—The favorite bee with the majority of bee keepers, and especially with Northern bee keepers, is the Italian. This bee comes orig-

inally from Italy, is of medium size, and the workers have three distinct yellow or golden bands upon the abdomen, the remainder being of a dark leather or brownish color. The thorax (that part of the body to which the wings and legs are attached) is covered with a dark yellow pubescence —a coating of fine hairs closely set. They are as a usual thing of a remarkably even temperament, and can be handled readily with the use of smoke. When handled rapidly and roughly, as is frequently the case during a heavy honey flow, they are not nearly so quick to battle as are both the Cyprians and Blacks, and can be depended upon to give a better average honey crop than the latter. While Italians are usually easier to handle than Blacks they are found to better defend themselves against natural enemies, and especially against the wax-moth. In fact the Italian bee is the best bee for the beginner to select and better adapted to a greater variety of conditions than any other. Where it is not practicable to make a start with pure Italians the ordinary Blacks can be easily Italianized by giving each colony a tested Italian queen.

Golden Italians.—These have been produced by selective breeding from the regular Italian, special reference being given to securing as much yellow as possible on the abdomens of the workers and drones. The best Goldens show distinctly five yellow bands upon the abdomen, and at a short distance appear to be of a pure golden color entirely. The Golden has been bred exclusively with a view to appearance, and while Mr. W. O. Victor, of Wharton, Texas, has produced a strain that proves to be excellent honey gatherers, the breeding process has often been at the expense of honey gathering and other qualities, and has doubtless in many cases resulted in a reduced vitality. For the bee fancier they are well adapted, but for the average bee keeper the regular three-banded or imported Italian is to be preferred. The latter differs but little from the familiar three-banded Italian, but as a usual thing the direct descendants of an imported queen show a darker color than those which have been bred in this country for some time. For this reason the recently imported bees are often designated as "leather-colored" Italians. They are preferable to the Italians that have been "American-bred," except in cases where the breeding of the latter has been of a strictly selective nature with a view to producing the best bee possible.

Hybrids.—Having given the five distinct races—Carniolans, Cyprians, Holy Lands, Blacks and Italians—there are possible ten distinct hybrids as the result of the first cross, one race with another. Owing to the abundance of the Italians and the Blacks, the cross between these two races is the one most frequently met with, and the one popularly designated as hybrid. In many cases these hybrids are found to be as good average honey gatherers as the pure Italians, and in many cases exceptionally energetic workers. This doubtless results from the stamina due to the addition of foreign blood. While reputed generally among bee keepers to be of a cross disposition, our own experience is that they are not crosser than the Italians, and in many cases a colony is found that is much more docile than the average colony of the latter race. The amateur bee keeper, in Italianizing an apiary of Blacks, will invariably get Italian queens mated to Black drones and in the resulting bees he will have a vast opportunity for observation on these points.

HOW TO SECURE BEES.

If the beginner does not happen to have bees in box hives, his best plan of obtaining bees will be to purchase them, provided, of course, that he can get them at a reasonable price. What constitutes a reasonable price must depend upon locality, condition and amount of the honey crop, as well as upon the strength of the colony, amount of honey contained in the hive, and the style or make of the latter. As a general rule it may be considered that for either Italians or Black bees in box hives, with a reasonable amount of honey, a price of $1.00 to $1.50 is amply sufficient. For colonies in frame hives of antiquated or worthless patterns, and the frames of which are of such a size as to fit the regular ten-frame dovetailed hive, a price of $2.50 to $3.50 usually prevails. Black bees or hybrids, with queen of the same kind, in dovetailed ten-frame hives are worth on an average of $3.50 to $4.00 per colony. Colonies in new or perfect ten-frame dovetailed hives with ten frames of honey and brood, a strong force of working bees, and a good Italian queen, command the uniform price of $5.00 each. These prices may be higher or lower according to demand, and according to whether the purchase is made just previous to a honey season or just after it. In more favored parts of the State, strong colonies in early spring often sell for as high as $10.00 each, while in late summer they may not bring more than $3.00. Colonies in bee trees as a usual thing are worth no more than the time and labor required to take them out and transfer to frame hives. At times, however, the honey obtained in addition to the bees is sufficient to pay handsomely for the work and the bees remain as profit. While it is not generally profitable to pay parties for bee trees, a quarter or half dollar invested in their good will may ultimately be found profitable.

LIFE AND HABITS OF THE BEE.

In order to be a successful bee keeper one must understand at least something of the domestic economy of the hive, and must have a knowledge of the way in which bees are reared, honey stored, combs built, etc., A knowledge of all this will make clear to the novice how he may perform certain work and operations without disturbing the domestic arrangements of the bees and how he may in many cases aid them in their work, thereby increasing the honey yield and avoiding losses of both bees and honey. Inside of the hive will be found three distinct forms of adult bees, namely, the queen, workers, and drones (see Plate II). Only one queen is found in each colony, and her sole duty is to deposit the eggs from which all bees are hatched. She alone is the egg layer and is the mother of all bees hatched in the hive. Having no other duty to perform she is specially adapted by nature for her egg-laying duties. She is even fed by worker bees, who accompany her constantly and see to her wants. From cell to cell she goes quietly at her work, depositing in each a small white egg, cylindrical in form and approximately 1.8 millimetres (about 7-100 of an inch) in length. In appearance the queen is much longer than the worker bees and is also slightly thicker and broader. However, on account of her lengthened abdomen, she appears much more slender. Her abdomen is not as distinctly banded as that of a worker and is usually of a uniform tawny or dark color throughout. The thorax is

Worker.

Queen.

Drone.

PLATE II. (From A. I. Root, A B C of Bee Culture.)

almost devoid of hairs and presents a shining appearance. A good queen will, during the honey season, lay as high as 1500 to 2000 eggs per day. Usually she will continue active egg laying for two years, often three, after which time she is usually superseded by a young queen.

The workers are by far the most abundant individuals in the hive, numbering in strong colonies about 40,000. They are the units of organized labor and to their lot fall all the duties of the hive, except the egg laying and fertilizing of the queen. They build the comb, gather the honey, keep up the temperature and ventilation of the hive, brood over the eggs, feed the young bees or larvæ, and protect the community from robbers and other enemies. In appearance they differ from the queen by their shorter and somewhat smaller body, and by marked pubescence upon the thorax. Both the queen and workers are provided with stings, but the queen rarely makes use of hers, even when roughly handled in the fingers or perhaps mashed, and it is supposed that she only uses that weapon when in a fight with a rival queen. The workers when angered do not hesitate to use their stings. The drones will be found more abundant at certain seasons than at others, and especially are they plentiful at the approach of swarming time in the spring. Hardly to exceed two or three hundred are to be found at a time in each colony, and as a usual

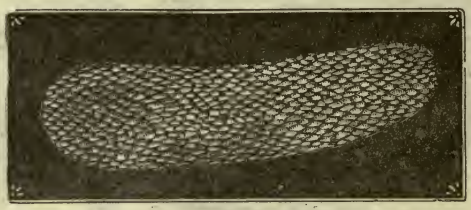


Fig. 1.—Queen's egg, highly magnified. (From A. I. Root, A B C of Bee Culture.)

thing fifty to seventy-five will nearly be the correct number during the summer and autumn. They may be readily recognized by their immense size as compared with the workers, and by the fact that their abdomens are blunt and rounded, instead of sharp at the apex as are those of the queen and workers. (See Plate II.) Big and clumsy appearing fellows, they have no part in the economy of the hive, and their sole object of existence is to fertilize the young queen which, under natural conditions, appears in the colony about once a year. They gather no honey, do no work, and merely consume stores. At the approach of winter or upon a dearth of honey they are one and all ruthlessly killed or expelled from the hive to perish, by the workers. The drone develops from an unfertilized egg, and as the queen seems to have the power of laying fertilized or unfertilized eggs at will, drones are produced whenever needed, as at the beginning of the next honey flow or at the approach of swarming time.

The egg described above (see Fig. 1) when seen under the microscope presents a beautiful appearance, being covered with a net-work of fine lines. At the end of about three days after deposition the egg hatches, having been previously surrounded with a milky food by the worker bees. The egg produces a very small, pure white larva, the growth of which is very rapid. For six days it is fed by the worker bees and at about the

tenth day after egg deposition is sealed over with a thin covering and left to gradually molt and take on the form of the adult bee. Twenty-one days after the egg was laid in the case of the young worker bees, and twenty-three days in the case of the young drones, the bee has completed its growth, gnaws open the covering of its cell, and crawls out, a perfectly developed bee, but nevertheless looking a bit rough, fuzzy and clumsy. Soon it grooms out the small hairs covering its body, rapidly gains command of its legs and goes to an unsealed cell of honey for its first meal. After the first or second day out of the cell, the young worker takes up the duties of "nurse" and prepares and gives food to the larvæ. Under average conditions, according to Mr. A. I. Root, this may be continued by the young bee up to any time from the sixth to the fourteenth day, after which it engages in comb building, honey gathering and the other duties of the hive, now being a fully developed bee in every way.

Fig. 2.—Ten frame dove-tailed hive. (From A. I. Root, A B C of Bee Culture.)

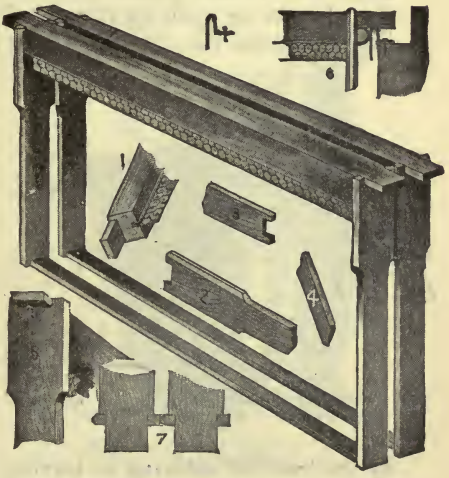


Fig. 3 —Hoffman self-spacing frames. (After A. I. Root Co.)

The younger bees do not do much in guarding the hive until they reach at least middle age. The younger bees can be handled with impunity and will not sting, and it is the old bees in the hive that make trouble for the operator when the hive is opened or disturbed.

In looking over the combs in a hive the majority of the cells will be found of a uniform size and making up the bulk. These are the worker cells. In spots, and sometimes occupying entire frames, will be noticed cells that are markedly larger than the rest. These latter are the drone cells, making up what is termed the "drone comb." It is in these cells that the drones, being larger, are reared. No material difference is noted in the larval history of the drone, from that of the worker, except that twenty-three days instead of twenty-one are required for the attainment of maturity.

The life history of the queen will be discussed under the head of "Swarming," to be mentioned later on.

HIVES.

That the bees may be properly observed, that queenlessness may be avoided, and remedied when it does occur; and in order to see that the bees do not run short of stores, as sometimes occurs in an unfavorable season, it is necessary that we use a hive in which the combs are readily movable, so that they can be removed for examination at the convenience of the bee keeper. We, therefore, have what is designatd as the "frame hive." Many different sizes and designs have been manufactured for this purpose and a large variety are in use today by the various bee keepers, each particular kind having its advocates. The hive in most extensive use, and above all others best adapted for the beginner, is known as the ten-frame dovetailed hive. This is shown in Fig. 2. It consists of a movable bottom-board upon which is fastened, on top of both sides and one end, a cleat. The "hive-body" proper, consisting of an oblong dovetailed box, is next placed on the bottom-board and the cleats above mentioned leave an opening at one end, designated as the front. This opening constitutes the entrance to the hive and is the only passage way used

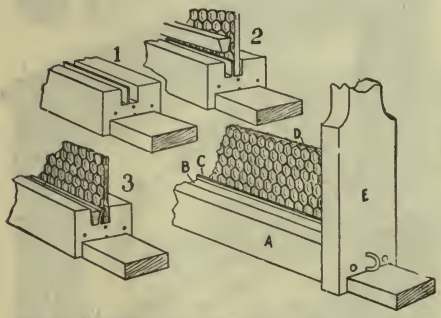


Fig. 4.—Method of inserting foundation into Hoffman frames. (After A. I. Root Co.)

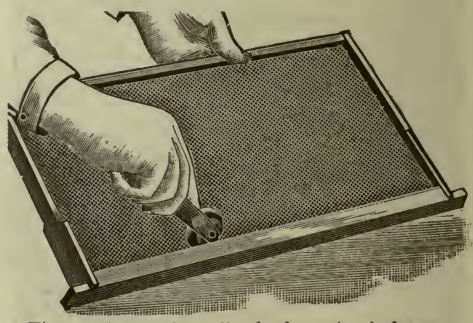


Fig. 5.—Foundation roller for fastening in frames. (After A. I. Root Co.)

by the bees for entering or leaving. Inside the hive-body are ten frames having protruding top bars, which rest upon tin rabbets within each end of the body. In each of these ten frames a comb is built by the bees, all being readily removable. As with hives, we have also a variety of frames. The one most popular and best constructed is designated as the "Hoffman" frame. Two of these are shown in Fig. 3. It will be noticed that one side of the end of each frame has towards the top a V-shaped projection; while the opposite side of the frame has a plain surface. When placed side by side in the hive, these V-shaped projections keep the frames the right distance or a "bee space" apart. This is an important feature, as when the frames are placed too close together insufficient room is left for the bees to cluster above the brood and for carrying on their work. If, on the other hand, the frames are too far apart, the bees will attempt to fill up the extra space by building combs from one frame to another, producing what are termed "brace combs," and which will cause the frames to adhere firmly to each other when an attempt is made to remove them. By using the Hoffman frame, the beginner avoids these difficulties entirely, as the frames are self-spacing. Before the frames are placed in the hive, there should be in each a sheet of "foundation." This is

made by machinery and consists of a sheet of wax having impressed in it, on both sides, the bottoms of the cells, as well as a portion of the cell walls. As its name signifies, it is the foundation upon which the bees build their combs and by its use much time and labor is saved the bees, in addition to the fact that it insures straight combs. This foundation is fastened into the frame by means of a double groove and wedge, as shown in Fig. 4, or by using the foundation roller, shown in Fig. 5. The foundation next has imbedded in it three or four fine tinned wires, stretched tightly through the frame from end to end. This imbedding is done with a "spur wire-imbedder," which is no more nor less than a small steel tracing wheel, with alternating teeth. These wires serve to hold the comb firmly when built out, and prevent its sagging or breaking when shipped or handled. On no account should this wiring be omitted. Upon the hive-body is placed the cover, which is also made in various designs, but a good cover should be thoroughly tight and the boards

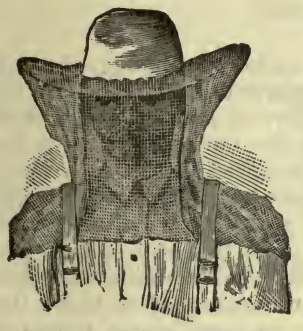


Fig. 6.—A serviceable bee-veil. (After A. I. Root Co.)

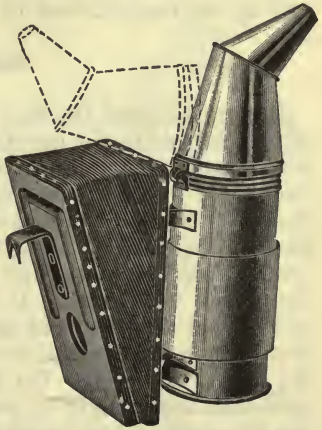


Fig. 7.—Corneil smoker. (After A. I. Root Co.)

should be prevented from warping by being inserted in a grooved end-piece. When surplus honey is being gathered by the bees a "super" or upper story is placed above the hive body and the cover upon top of the super. Supers will be further discussed under the head of "Honey Flow."

OTHER APPARATUS.

In addition to the hives, it is imperative that the bee keeper have a good strong veil and a smoker. The veil best adapted to this purpose is made of cotton tulle, with a silk tulle face, and is illustrated in Fig. 6. The cotton tulle is durable and the face of silk tulle does not interfere with the sight. If the beginner is a bit timid, it may be well to have a pair of gloves, either of cotton oiled with linseed oil or of common leather not too thick or stiff. After a little familiarity with the bees the gloves will be found entirely unnecessary, except in the case of extremely cross colonies. While in practice it is well to dispense with the gloves, the veil should always be worn, as a matter of precaution against sudden attacks

from the bees, which may be occasioned by robbers, dropping a tool on the hive, or otherwise. Especially is this true with the beginner, who may at times feel a little nervous. This nervousness will in a short time wear off, however, even with the most timid. When the bees show a tendency to crawl up the trousers legs, this can be prevented by tucking the latter into a pair of high-topped boots, by wearing leggins, or by putting on a pair of ordinary bicycle pants-guards. A good smoker is necessary and the Bingham or Corneil smoker will be found to give the best service and to be the cheapest in the long run. The Corneil smoker is represented in Fig. 7. For fuel in the smoker almost any dry substance, not making too strong a smoke, may be used. We have found that pine shavings make an abundant smoke, and when once thoroughly on fire and well packed will hold fire for a long time. The pine shavings, however, have the disadvantage of gumming up the smoker. Cedar bark, thoroughly dry, is a fine smoker fuel, as is also cotton rags, or dry ash or mesquite wood. In no case should such things as sulphur or tobacco be used in the smoker, even in the smallest quantities.

HOW TO OPEN A HIVE.

Having adjusted the veil, and having the smoker well going, blow one or two puffs of smoke into the entrance of the hive to be opened. Do this with a good strong closing of the smoker bellows so as to drive the smoke thoroughly into every part of the hive. This does not mean that the bees should be deluged with smoke. All that is required is that each bee in the hive should get a whiff, however light it may be. Next grasp the hive cover by one end and gently raise it, blowing a puff or two of smoke into the crevice thus made. In the majority of cases this will be sufficient, and further smoke will be unnecessary. In case while working with them they fly out and attempt to sting, a little more smoke may be blown into the hive from above. On general principles no more smoke should be used than is necessary to prevent them from stinging. Smoke demoralizes the bees and as considerable time is required for them to recover from a severe smoking, much time and consequently honey, is lost by them. As soon as smoke enters the hive and the bees are disturbed the majority of the workers go to the unsealed honey and proceed to fill up, presumably on the supposition that their home is about to be destroyed, and in being compelled to leave they propose to take with them as much of their treasure as possible. When a bee is well gorged with honey it will show no disposition to sting, and where exceptionally cross colonies are to be managed they will be found more docile if a puff of smoke is blown into the entrance about five minutes previous to opening. This will give the bees time to gorge themselves with honey and they will not be as pugnacious as they otherwise would be. In opening the hive, if the cover sticks, do not jerk it off, but use a small screw driver, pocket knife, or other instrument to gently pry it. Having removed the cover, jar the bees off in front of the hive, turn the cover on edge or end and sit down on it. Now gently push the frames apart, or, if stuck tightly, pry them apart with chisel or knife and lift out the one that is to be examined.

It will be noticed that where the cover joins the hive and where the frames touch each other and the ends of the hive, is found a grayish yellow substance of a very adhesive nature. This is "propolis," or bee glue,

which is gathered from various plants and flowers and is used as a cement for making secure all parts and for sealing up all openings and crevices in the hive, except, of course, the entrance. It is this that sometimes causes the cover to adhere tightly and the frames to stick together. Lift the frame by the ends of the top bars and keep the entire frame *vertical,* as shown in Fig. 8. When it is desired to examine the reverse side of it turn it up on end, without changing the hold, and always *keeping the comb in a vertical plane;* next revolve the frame through a half-circle, using the top bar as a pivot (see Fig. 9). The reverse side will now be towards the operator and can be examined at leisure. This method of handling is to prevent any possibility of the comb breaking or sagging, and is especially necessary in hot weather and when combs are not wired. It is based upon the very simple principle that the comb hanging directly down from the top bar, or supported by the top bar when reversed, is not nearly so liable to sag as when the comb is held in a horizontal plane sup-

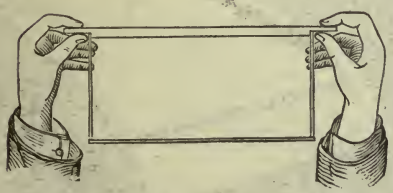


Fig. 8.—Handling frames—first position. (From A. I. Root, A B C of Bee Culture.)

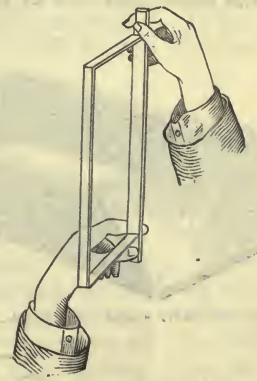


Fig. 9.—Handling frames—second position. (From A. I. Root, A B C of Bee Culture.)

ported by the top bar at one edge only. If the colony is in prime condition plenty of bees will be found clustered on all combs, the two frames next the outside of the hive will be found filled with honey, much of it sealed, and the ends, and about one or two inches along the tops of all other combs will also contain honey. In the central frames of the hive will be found sealed larvæ, which, by its even surface and dark-brown color, is readily distinguished from the sealed honey, unsealed larvæ and eggs, each of the latter being attached by its end to the bottom of the cell. This part of the hive containing eggs and larvæ is designated as the "brood nest" of the queen and in it or near its outer edge she will usually be found. At times she appears to take little excursions to the most remote parts of the hive, probably by way of exploration, and may be found in a remote corner. Especially if much smoke has been used in opening the hive the queen will become alarmed and make every effort to elude the operator by running from comb to comb, dodging around corners of the frames, and crowding under thick clusters of bees. A little practice will enable the bee keeper to locate her easily. The brood nest may cover the greater part of seven or eight frames during the height of

the honey season, and from this number of frames on down to one or two, in the case of a dearth of honey. During the winter season very little or no brood will be found. In cases of severe drouth, also, the queen sometimes entirely ceases egg deposition.

After examining the colony the frames should be replaced *in the same order in which they were previous to opening* in order that the brood nest of the queen shall not be disorganized. Having the frames all replaced, push them over against one side of the hive, as close as they will go, and as close to each other as the V-shaped projections will allow. They will then be correctly "spaced" without further attention. This will of course apply only to the Hoffman or other self-spacing frame. In some localities the "all-wood" frame is used extensively. These latter are not provided with any self-spacing device and must be placed the proper distance apart (one-fourth inch) by the operator. Their only advantage lies in the fact that they are a trifle cheaper than the Hoffman frame, but the time lost in spacing them correctly is worth more than the additional cost of the Hoffman. The hive after each opening should

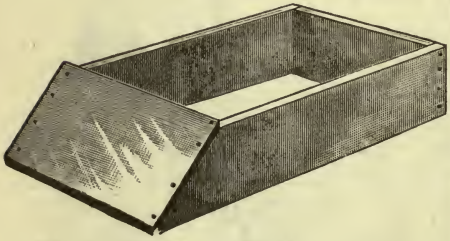


Fig. 10.—Hive stand. (After A. I. Root Co.)

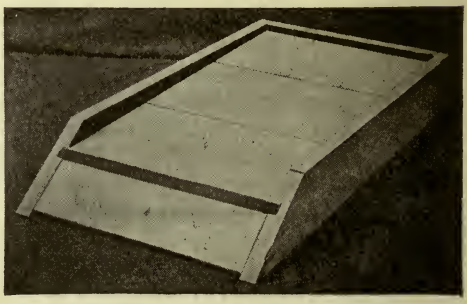


Fig. 11.—Combined bottom board and hive stand. (After A. I. Root Co.)

be carefully closed, pains being taken to see that no cracks or openings are left between the hive and cover through which robbers might enter. In windy weather a brick or rock should be placed on top of cover.

LOCATION OF HIVES AND APIARY.

The best location for an apiary is in a shady grove of deciduous trees, where the branches are sufficiently high so as not to interfere with the flight of the bees, or to catch upon the veil, or in any way interfere with the work about the apiary. A peach orchard is an ideal location, care being taken to have each hive located upon the north side of a tree or bush so that it will be shaded during the greater part of the day. Each hive should be slightly raised from the ground, either by means of bricks or scantlings, or, better still, by a hive-stand, such as is shown in Fig. 10. The hive should also slope towards the front or entrance—a drop of one-half to one inch being sufficient. A "combined bottom-board and hive-stand" (see Fig. 11) is used by many bee keepers. With this the hive may be set level, and yet the inclined bottom-board will give the necessary slope to carry off all water that may enter the hive during rains. All grass and weeds around the hive, and especially in front of the en-

trance, should be kept cleaned away. As to the plan of location, a great latitude of choice is allowable. It is important, however, that hives having entrances facing in the *same direction* should not be nearer to each other than ten feet. Hives may be faced in any direction, but a north face is least preferable. East is perhaps the best of all, and as a second choice south should follow. Mr. Louis H. Scholl, of Hunter, Texas, has found a southeast face to give the best results. By such an entrance the morning sun strikes the hive squarely and warms it early. Later in the day the rays do not strike either the side or end directly until late in the afternoon, but at more or less of an angle, making the heat within less intense. In some cases it is found necessary to place some of the hives in direct sunlight, in which case a "shade-board" should always be placed on such hives. This shade board may be of any design, so that it projects beyond the cover of the hive for a few inches in every direction. Such a board will also give better protection from the heat if it be raised by means of cleats above the hive cover, so as to allow a circulation of air beneath it. In no case should this board be attached to the cover, but should be merely laid upon it, so as to be readily removable. If any device is needed to prevent wind from blowing it off, a rock or other weight will suffice.

APPARATUS NECESSARY FOR EXTENSIVE WORK.

While the outfit described above will suffice for the small bee keeper who is producing honey for his own use, and only a limited amount for sale, yet he will find that there are a number of implements very convenient; and in case he intends enlarging his apiary ultimately, implements that are necessary in saving time and in putting his products into marketable shape. A few of these will here be mentioned. A honey extractor is one of the most useful and labor-saving devices yet invented for the bee keeper. Its purpose is to extract the liquid honey from the combs, so that the latter may be returned to the bees to be again filled by them. This saves much time during the height of a honey flow. As it requires several pounds of honey to make a single pound of comb, it will be seen that much honey is saved by thus using the same combs over and over again. The honey extractor is constructed on the same principle as is the cream separator, i. e., centrifugal force. The extractor consists of a galvanized iron can having within it two, four, or more pockets, each of which will receive a frame or comb of honey. These pockets are mounted upon a frame pivoted at top and bottom, so that it can be revolved rapidly by means of attached gearing and handle. The rapid motion throws out the honey from the outer cells of the comb, whence it runs down the sides of the extractor and is drawn off through a gate below. The frames are now reversed or turned with the other face to the outside of the extractor and the frame is again revolved, throwing out all the honey. The comb is now ready to be returned to the hive. Honey extractors are manufactured in various styles and sizes adapted to more or less extensive work. A well-built extractor, capable of holding two combs at a time, such as is shown in Fig. 12, is amply large enough for an apiary of 100 colonies or less. Along with the extractor a honey knife or "uncapping knife" will be needed for cutting comb, cleaning, and especially for shaving off the cappings of the sealed honey before extracting. Such a knife

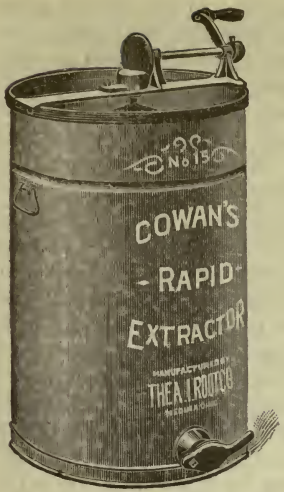


Fig. 12.—2-frame honey extractor. (After A. I. Root Co.)

Fig. 13.—Bingham honey knife. (After A. I. Root Co.)

is shown is Fig. 13. Next in importance comes the "solar wax extractor" for reducing combs and scrapings to wax. This consists of a box covered with glass, and having inside it a metal tray painted black, into which the combs are dropped. At the lower end of this tray are one or more tin vessels for catching wax and honey. When placed in the sun the heat of the latter melts the comb and allows all honey and the greater part of the wax contained to run down into the vessels below, from which they can be taken at leisure. After being allowed to cool the wax in the pans will solidify and can be taken out in cakes. This wax extractor should be kept in the apiary exposed to the direct rays of the sun at all times and into it should be thrown all old broken combs, scrapings of wax, etc. The wax obtained in this way will in a short time pay for the original cost of the device. One of the smaller sized wax extractors, suit-

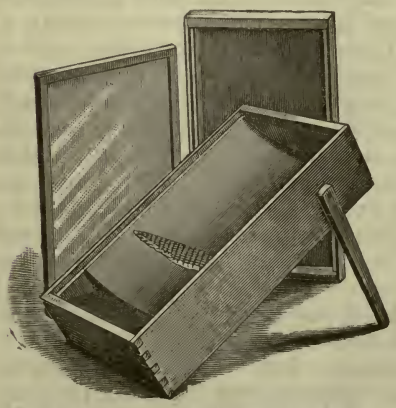


Fig. 14.—Doolittle solar wax extractor. (After A. I. Root Co.)

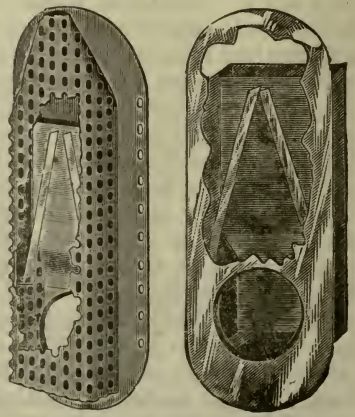


Fig. 15.—Porter bee-escape. (After A. I. Root Co.)

able for an apiary of forty colonies or less, is shown in Fig. 14. The bee-escape, illustrated in Fig. 15, should be placed at the tops of all screen doors and windows of the extracting house to allow the escape of bees carried in on combs.

Other apparatus, such as shipping cases, wax presses, etc., will suggest themselves to the bee keeper as he progresses in experience and as his apiary increases in size.

TRANSFERRING.

The bee keeper having his bees in box hives or wishing to secure a colony from a bee tree will desire information on transferring them into a frame hive. The "Heddon method" of transferring is perhaps the simplest and easiest for the amateur. This is described by the A. I. Root Co. as follows:

"We will assume that your hive or hives, having been received in the flat, are put together and painted, and contain frames of wired foundation ready for the bees. Light your smoker and put on your bee veil. Move the old hive back four or five feet, and put the new hive in its place. Prepare a small box about eight inches deep, and one side open, that will just cover (not slip over) the bottom of the box hive. Turn it upside down; set the hiving box over it, and then drum on the sides of the hive with a couple of sticks until about two-thirds of the bees pass up into the box. Gently lift off the box containing the bees, and dump it in front of the entrance of the new hive. Make sure that the queen is among them, by watching for her as she passes with the rest into the entrance. If you do not discover her look inside the hive. If you still fail to find her, drum out bees from the old hive again until you do get her, for, to make the plan a success, she must be in the *new* hive."

"Return to the box hive and turn it right side up and set it down a couple of feet back of the new one, with its entrance turned at right angles. You now have in the hive about one-third of the original colony, the combs, and all the brood. Allow the old hive to stand for at least twenty-one days, at the end of which time the brood will be hatched out, with the exception of a little drone brood, which will be of no value. Turn the hive upside down and drum the bees out again into the hiving box, after which dump it in front of the entrance to the new hive as before. If the queen in the new hive is one you wish to keep, put an entrance guard over the entrance to catch the young queen hatched in the meantime in the old hive, for she would go in and one or the other would be destroyed. If there is no choice of queens let the second drive of bees go in and the queens will fight it out. Your job of transferring is now completed, and all you have on hand is an old box hive containing a lot of crooked combs, with perhaps a little honey and drone brood in it. The honey can be extracted, or used for chunk honey on the table, if fit for use."

This method, however, must *never* be used except *during a strong honey flow,* when the bees of other hives are busy gathering honey in the fields. At any other time the box hive, after the bees are removed, will be attacked by robbers—bees from other hives—the brood killed, and all honey carried away. Aside from the damage done directly, a bad case of robbing may seriously demoralize the entire yard and result disastrously.

Another and better method is to cut out the combs from the box hive, selecting the straightest of them, fit into the frames and fasten them there by wrapping with a light cotton cord. Replace these frames in the new hive, which should now be located on the former location of the box hive, and the bees shaken into it or dumped in front of it. By this method, with reasonable care, robbing is prevented and all honey and brood is saved, as well as time saved the bees in constructing new comb.

ROBBING.

If bits of honey be dropped about the apiary, or left where bees can obtain access to them, this will start what is termed "robbing." The bees finding this honey will gather it up and carry it away to their respective hives. When this supply is exhausted they will greedily search for more, and if none is to be found will attack some adjacent hive. If the colony in the latter is weak, the invaders will conquer, killing a majority of the rightful occupants, destroy the brood, and carry off the honey. If the attacked colony is strong a pitched battle ensues, the result of which will be hundreds of dead bees on both sides, even though the robbers be repulsed. Once in the habit of robbing, this habit is liable to be kept up for days or even weeks. Whenever a hive is opened the robbers are on hand and immediately plunge in. For this reason no honey should ever be left exposed and during a dearth of honey hives should not be kept open longer than is absolutely necessary.

When robbing has once started, the entrances of all adjacent hives, and especially of the hive being attacked, should be closed down to a small aperture. Wet grass or weeds thrown over the entrance of the attacked hive will also assist its inmates in repelling the robbers.

PREPARATION OF BEES FOR WINTER

In the Texas climate, extensive preparations for winter are unnecessary, except that all colonies should be strong in numbers, be in tight weather-proof hives, and have ample stores of honey. These three requirements, however, hold good at all times. The careful and often extensive wintering preparations of the North, such as packing with chaff cushions, placing in cellar, etc., are here unnecessary. At approach of cold weather the entrances should be closed down to a small opening, depending in size upon the severity of cold and the strength of the colony, to better enable the bees to maintain the temperature of the hive.

FEEDING.

If deficient in numbers or in stores in the autumn, and no fall honey flow comes on, the bees should be fed both to stimulate brood rearing and especially to furnish supplies for winter. While there are a number of devices for this purpose, the one which has given best results and the one which does not in any way encourage robbing, is the one called the Doolittle or "division-board" feeder, illustrated in Fig. 16. This consists of a trough having in its top a half inch auger hole; this trough or feeder is placed in the hive, in place of one of the lateral frames. Feed should be made of one part granulated sugar and two parts of water.

The syrup should not be heated in making. By stirring the water and adding the sugar slowly the latter will be found to dissolve readily. The bees should be fed each evening at or a short time before sunset. In feeding, take off hive cover, insert a funnel into the opening in top of feeder and pour in the syrup. When feeding to stimulate brood rearing about one pint of the syrup should be fed daily, and the amount gradually increased as the colony increases in bees and brood. When feeding for stores alone, the syrup should be made of one part sugar to one part water, and can be fed in larger quantities; in fact, fed as rapidly as the bees will remove it and store in the combs.

In the vicinity of Uvalde, Texas, when feeding for stores, the bee keepers use "peloncellos," a sugar manufactured in Mexico, from cane, without being in any way refined. Cones of this sugar, weighing about thirteen ounces each, are placed in an empty super above the brood nest, and the bees allowed to help themselves. According to Mr. J. K. Hill, of Uvalde, this sugar does not stimulate brood rearing when fed in this way. As a feed, it is cheaper than cane sugar, costing about 3½ to 4 cents per pound.

The careful bee keeper will at no time of the year allow his colonies

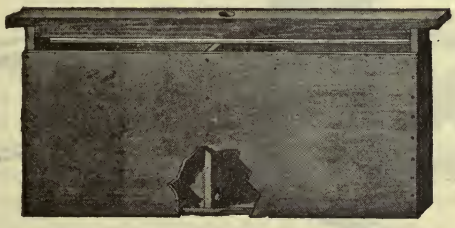


Fig. 16.—Division-board feeder. (After A. I. Root Co.)

to run short of stores. During the summer season, in case of all honey in a hive becoming exhausted, the colony invariably swarms out and hunts for a new location, thus being lost.

THE HONEY FLOW.

During the spring many native plants, trees and vines yield an abundance of nectar. This is termed the "honey flow" by bee keepers. The honey flow in Texas may occur any time between February 15th and May 15th, and in duration may last from two weeks to three months or longer, according to locality and season. Honey flows are designated as "spring," "late summer," or "autumn," according to the season in which they occur, the spring honey flow being the most important. As soon as the weather becomes warm enough for the bees to fly, and the flowers commence yielding nectar, brood rearing is begun in the hives. As the flow of honey increases, more and more eggs are deposited by the queen, and the working force of the colony increases rapidly. If the colony is not at least of medium strength at the beginning of the honey flow, it will not attain its "working strength" in time to store much of the surplus honey. As soon as weather will permit in the spring all colonies should be examined and those found weak should be fed as men-

tioned above in order to start brood rearing and thus have a strong force of bees on hand at the very beginning of the flow if possible. Only a strong colony will store honey in the supers, and *keeping the colonies strong* is the most important point essential to success in the production of surplus honey.

SUPERS.

As soon as the bees in gathering honey have filled up the hive-body with brood and honey, a super or upper story should be given. Supers are of various kinds and styles, according to the form in which the surplus honey is desired. If "section honey," that is, honey stored in small frames containing a pound each—ready for market—is desired, a section super must be used. Two main types of sections are in common use, the "bee-way section" and the "plain section." The bee-way section is shown in Fig. 17.

It will be noted that the top and bottom of the section are provided with insets or bee-ways, so that when placed side by side in the super

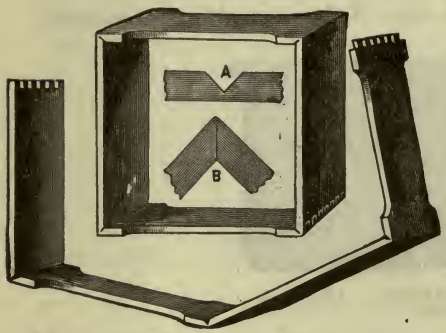


Fig. 17.—Bee-way section. (From A. I. Root, A B C of Bee Culture.)

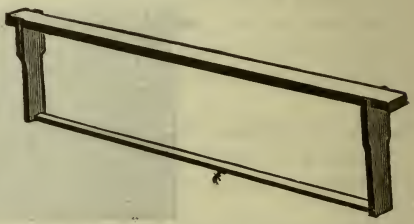


Fig. 18.—Hoffman shallow extracting frame. (After A. I. Root Co.)

there will be a bee-space between all of them for the entrance of the bees from the brood chamber below. This style of section is rapidly going out of favor and being replaced by the plain section. The latter differs from the bee-way section in lacking an inset in the top and bottom, hence its name. Instead, between each row of sections is a slatted "fence" or separator, which allows of free communication not only from one row of sections to another, but from section to section in the same row. This has the advantage of allowing the bees to remain in an almost continuous cluster among the sections instead of in almost isolated clusters as in the bee-way sections. In addition to this, the plain sections are narrower by just the depth of the bee-space in the bee-way section, and therefore more of them can be placed in a super at a time. Plain sections again are designated as "square" ($4\frac{1}{4}$x$4\frac{1}{4}$ inches), "Danzenbaker" (4x5 inches), and "Ideal" ($3\frac{5}{8}$x5 inches). Regarding the relative merits of these, space will not be taken here for discussion; suffice to say, that each bee keeper has his choice of these and for each certain advantages can be given.

If extracted honey is to be produced an "extracting super" should be used. This may be either a full depth hive-body—identical with the one

used for brood chamber—or it may be a "shallow extracting super" containing shallow extracting frames such as is shown in Fig. 18. These frames differ only from the regular Hoffman frames in that they are but 5⅜ inches deep. Where the full depth extracting super is used the frames should all be wired, but in the shallow extracting super this is unnecessary.

In Texas and throughout the Indian Territory, the popular demand is not for extracted honey, or for section honey, but for what is termed "chunk" or "bulk comb" honey. This is sealed comb honey packed usually in screw-top cans and having poured over it plenty of extracted honey to fill all interstices and spaces between the combs. This bulk comb honey is not known except in the territory mentioned, but as the popular demand is for honey put up in this way, it will be to the interest of the bee keeper to produce it. It has the added advantage that it requires less skill in manipulation, less work, and its advocates claim that during a given honey flow they can produce more of it than of section honey, and almost as much as of extracted honey. In price it varies between that of comb honey and extracted honey, and for the bee keeper is the most profitable to produce. Its popularity doubtless lies in the fact that it is comb honey with honey on both sides—outside and inside.

Regardless of which of the three varieties of honey the bee keeper produces—whether extracted, section, or bulk comb, he must adhere firmly to certain principles if he would obtain the maximum amount of honey. As soon as the white "brace combs" or bits of wax begin to appear at the tops of the brood frames, the super should be placed upon the hive. Regardless of whether it contains sections or extracting frames, these should contain full sheets of foundation—or at least starters, which are merely narrow strips of foundation in the frames or sections, instead of full-sized sheets. If possible, a frame of unsealed honey, or a few partially filled sections saved over from the previous season, or taken from another colony, should be placed in each super. These "baits" will induce the bees to enter the supers and commence work much sooner than they otherwise would. In case a colony obstinately refuses to go to work in the super, take an entire super—bees and all, from another colony during the middle of the day, and place on the obstinate colony, at the same time transferring the empty super to the other colony. This exchanging of supers will in the majority of cases start them to work in good shape. As soon as the first super is about half filled, lift it up and insert another empty one beneath it. By the time this is half filled, or over, the upper one should be nearly or completely finished and capped. This process of "tiering up" may be continued until the honey flow is nearly over, but extreme care must be exercised or a number of unfinished sections or unsealed honey will result. Before being removed from the hive all honey should be sealed. This indicates that it is sufficiently evaporated or "ripened" so that it will keep. If sufficient supers are not on hand to tier up during the entire honey flow, it will of course be necessary to extract from time to time, or remove the filled sections and substitute empty ones in their place. The same will hold true of those localities with an exceptionally heavy flow. In no case should honey be taken off before sealed, as by so doing its keeping qualities will be impaired and it will later turn sour or spoil.

CLEANLINESS.

Throughout the entire honey flow, while preparing the honey for market, and in fact at all times, the utmost cleanliness should be observed. In many cases the extracting houses of bee keepers present a sight that is far from inviting to the prospective purchaser of honey. Rusty and dirty extractors, dead bees, decaying and moth-eaten combs, and in some cases frames of decaying brood greet the eyes of the visitor. Such sights will destroy the taste and desire for honey regardless of "the purity of nature's sweet." There is absolutely no question but that the uncleanliness and lack of neatness tolerated by many bee keepers immensely injure the local demand for their products, and on the price of honey as a whole exert a depressing influence. Producers of honey have no cause to complain of "low prices" so long as they *fail* to put up an article that "for cleanliness and wholesomeness is unexcelled." An extracting house with an amount of dirt about it that would be a disgrace to a plug tobacco factory will drive away the most enthusiastic customer with an utter disgust for honey in any form. While it may be hopeless to try to reform some of the men who have followed this practice for years, yet we would caution the beginner, both for his own profit and for the good of the industry as a whole, to adhere to cleanliness throughout, in every detail.

PREPARING HONEY FOR MARKET.

Closely connected with taking off the honey crop, is the work of preparing honey for market. Sections should have all propolis scraped from sides and edges so as to present as clean and neat an appearance as possible. The sections should then be "graded." While there is more or less variation in grading rules according to locality, the following rules, taken from "Gleanings in Bee Culture," are to be commended:

Grading Rules.

"Fancy.—All sections to be well filled, combs straight, firmly attached to all four sides, the combs unstained by travel-stain or otherwise; all the cells sealed except an occasional cell, the outside surface of the wood well scraped of propolis.

"A No. 1.—All sections well filled except the row of cells next to the wood; combs straight; one-eighth part of comb surface slightly soiled; the outside of the wood well scraped of propolis.

"No. 1.—All sections well filled except the row of cells next the wood; combs comparatively even; one-eighth part of comb surface soiled, or the entire surface slightly soiled.

"No. 2.—Three-fourths of the total surface must be filled and sealed.

"No. 3.—Must weigh at least half as much as a full weight section.

"In addition to this, the honey is to be classified according to color, using the terms white, amber and dark; that is, there will be 'Fancy White,' 'No. 1 Dark,' etc."

Only Fancy, A No. 1, and No. 1 should be shipped, and even for local demand it is advisable to give the customer the best grade possible. No. 2 can be used as table honey by the bee keeper himself, or together with

the No. 3 sections carefully preserved for use as baits the following spring. Under the head of "production of section honey," the use of these sections was mentioned. While they *could* be converted into extracted honey and wax, yet their value in persuading bees to begin work in the supers is too great to permit of this. They should be carefully kept protected from the wax-moth. This can best be done by placing the super, filled with No. 2 and No. 3 sections, over a strong colony. Here there will be no danger of freezing and they will be perfectly protected from the moth.

In shipping section honey, the sections should be packed in light glass-front shipping cases, as shown in Fig. 19. The package should state clearly and neatly, as by a label or rubber stamp, the grade of honey, name and address of the producer, and when possible the name of the plant from which the bulk of the honey has been made.

Extracted honey, as stated on a previous page, should be taken only from sealed comb. While there are a very few cases and conditions

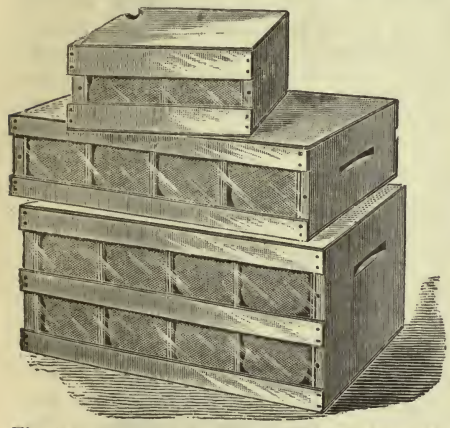


Fig. 19 —Shipping cases filled with section honey. (After A. I. Root Co.)

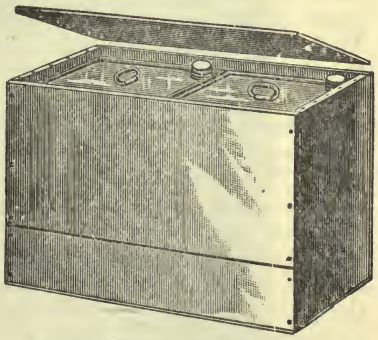


Fig. 20.—Shipping case for extracted honey. (After A. I. Root Co.)

under which unsealed honey is sufficiently ripened to keep indefinitely the beginner will do well to adhere strictly to the above rule. Extracted honey is packed for shipment in tin cans of various capacities; the 60 lb. (5 gallon) size being the one in most extensive use. Two of these 60 lb. cans in their shipping case are shown in Fig. 20. Extracted honey is also put up in smaller cans, in glass jars and bottles; and in barrels and kegs. It is not here necessary to discuss these. With extracted, as with all honey, the label should give definitely the name and address of the producer. Honey not so labeled is always open to the suspicion of being adulterated.

Bulk comb honey is best packed in what are termed "screw-top cans," which differ from the "extracted" cans above mentioned in having a large opening in the top, as large in fact as the size of the can will allow. Through this opening the comb honey is packed in layers until the top is reached, when extracted is then poured in to fill all open space between the combs. The opening is tightly closed by means of a screw-top.

Standard Packages.

Up to 1902, many sizes and varieties of honey cans had been used, when the Texas Bee Keepers' Association adopted as standard sized cans the three, six, twelve and sixty pound cans. In shipping, the three and six pound cans are crated in cases of sixty pounds each; while the twelve and sixty pound cans are crated in cases of 120 pounds. This standard should be strictly adhered to to prevent confusion in weights by customers and shippers.

MARKETING HONEY.

For those who are not extensive producers of honey, it is best to create and depend upon a local market. Honey is esteemed a delicacy, and in every locality some buyers will be found. If the bee keeper will maintain strict cleanliness in all his work, offer for sale only honey of good flavor thoroughly ripened, and advertise to a small extent, he will have no trouble in building up a local trade at good prices. Of course he should at all times give full or liberal weight when making sales, and at all times be perfectly straightforward and make no misrepresentations. These points are essential to success in any line of business. Where the crop is so heavy that it cannot be disposed of locally, the honey can be sold to the various firms who make a business of buying in a wholesale way, and who ship direct to the retailers. In other words, these firms are "honey jobbers," and must not be confused with commission men. The jobber buys at a specified price and makes his profit by selling again at an advanced price. The commission man sells the honey for the producer and charges a certain commission for his services. Of the former there are several reliable firms in our State, and one or two very unreliable ones. On the whole, however, it is better to sell outright to the jobber than to ship to commission men, unless, of course, the financial standing and reputation for *honesty* of the latter are unquestioned. The commission man often has the opportunity, and often does get for the bee keeper a higher price than if the honey had been sold to the jobber, but in many cases he also receives a lower price. Many extensive bee keepers find it profitable to work up a trade with grocers and others in distant as well as local towns, thereby combining the work of production with that of wholesaling, and getting the profits of both.

BEES WAX.

Bees wax is a product of the bees, and makes up the larger part of the constituents of the comb. When the necessity for comb building occurs in the hive, as at the approach of the swarming season and the honey flow, a greater or lesser number of bees gorge themselves with honey and cluster from the top of the hive or upon the comb, remaining quietly for some time. Presently (varying from one-half to three days, according to different authorities) little scales of wax appear upon the under side of the abdomen, being the resulting secretion of certain glands located at that point. These minute scales are then taken—probably in the majority of cases by other bees, and carried to the newly building cells. Here, by being thoroughly worked up and mixed with secretions, they are added to the foundation, to make the complete comb, or built

directly into comb if foundation is not present. Ordinary comb is made up, therefore, largely, but not entirely, of pure wax. In working about the apiary all bits of comb, whether old or new, spoiled or broken foundation, burr and brace combs, and all such should be placed in the solar wax extractor, described on a previous page under the head of "apparatus." These small savings will in the course of a year amount to considerable, and will more than pay for the time and trouble required. In order to whiten the wax and make it more presentable, it may be placed in the solar wax extractor several times in succession, the sun having a marked bleaching effect upon it. Wax is in good demand by all manufacturers of foundation and of bee supplies, and commands a ready sale at all times. Wax should never be adulterated in any way. Aside from moral reasons, such adulteration is readily detected, and furthermore,

Fig 21.—Root-German Steam Wax-press. (After A. I. Root Co.)

any adulteration renders the wax entirely worthless. Space will not be taken here to discuss the various adulterants used or the methods employed in detecting them.

While the solar wax extractor, by the action of the sun, will remove the greater part of the wax, a portion still remains in the refuse or "slum-gum," as it is called. Until comparatively recently no efficient method was known for extracting the remaining wax from the slum-gum. The A. I. Root Co., of Medina, Ohio, have recently perfected what is known as the "Root-German Steam Wax-press," which by the application of steam and pressure simultaneously, forces the greater part of the wax from the slum-gum. The machine is a marked success, and in apiaries of forty colonies or over will soon pay for itself in the wax saved. This machine is shown in Fig. 21.

SWARMING.

All forms of life, that they may not become extinct, have some method of reproduction. In the case of the greater number of animals

this reproduction is merely the reproduction of individuals. In the case of bees it will be seen that the increase of individuals alone would only result in the strengthening or maintenance of the colony. Were reproduction of individuals alone the only method of increase, the species would ultimately become extinct, for a colony under natural conditions cannot exist indefinitely. In all forms of communistic life in the animal kingdom, we find also a division of communiites or colonies. In the case of bees this division takes the form of "swarming," and will be here briefly described. In the spring when the plants are yielding plenty of nectar and pollen, the combs are rapidly being filled with honey, and the young bees increasing rapidly within the hive, the bees become possessed of the "swarming fever." Regarding the cause or nature of this but little is understood except that it is the instinct calling for a division of the commonwealth. The changes and actions that take place within the hive at such a time are well understood, however remote the real nature of the swarming fever. At this time the bees evidently prepare

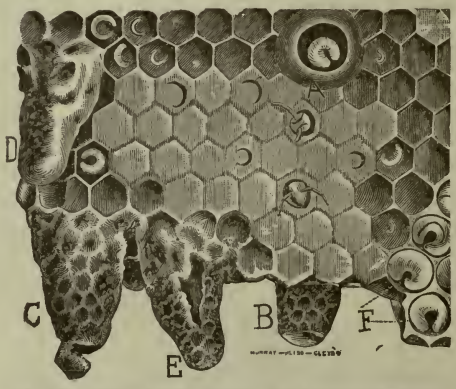


Fig. 22.—Queen cells. (From Root, after Cheshire.)

specially constructed cells, in which the queen deposits eggs, these eggs differing in no way from those which regularly produce workers. As soon as hatched, the young larvæ in these cells are fed by the nurse bees with a special food designated as "royal jelly." Regarding the nature and composition of the royal jelly little is known, except apparently through its influence and great abundance the sexual organs of the larva are fully developed during growth and do not remain rudimentary and useless as in the case of the worker bee. The queen cell is much larger than the ordinary cell, and is elongated so as to form a cone-shaped receptacle, very easily found upon the comb, usually at the lower edge of the latter. (See Fig. 22.) The queen requires a shorter time for development than does the worker, and during her entire larval and chrysalid periods is protected by the bees from the old queen, who, if permitted, would destroy her. Nine days after the egg is deposited the queen cell is sealed over and in seven days more the perfect queen emerges. At this time, and frequently before, weather conditions being favorable, the old queen and a large portion of the bees in the hive swarm out, and seek for another location. Soon after leaving the hive they usually cluster

on a limb or bush, and remain there for some time, varying from a few minutes to several hours. It is supposed that while thus clustered they send out scouts to find a suitable location, as a hollow tree, wherein the new colony can make its home. This habit of clustering before leaving definitely makes it possible for the apiarist to capture the new swarm, although in some cases they depart from the apiary without showing any inclination to cluster. Evidence is at hand, also, that a swarm may wander about for several days or longer, gradually losing in numbers until entirely destroyed; or, in event of their not finding a suitable location, will sometimes cluster beneath a protecting limb and there construct combs in the open air and proceed to brood rearing and honey storing.

When clustered upon a limb the colony is easily secured by cutting off the limb upon which it is clustered and shaking the entire swarm

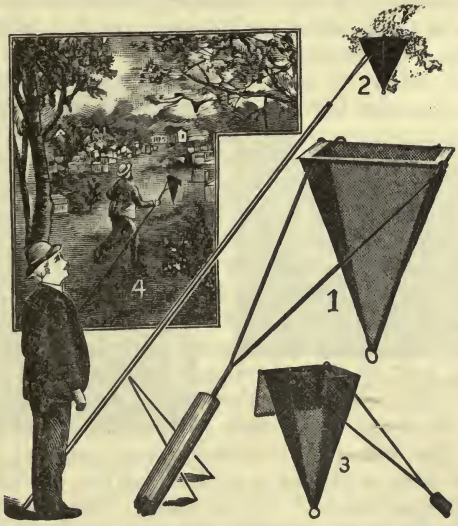


Fig. 23.—Manum's swarm-catcher. (After A. I. Root Co.)

off onto the ground in front of the hive which it is desired they should occupy. This hive should be prepared before hand and placed in its permanent location, awaiting the swarming time of the bees. The frames should all contain full sheets of foundation, wired, and when the swarm is placed in the hive a frame of brood, without bees, should be taken from another colony and placed therein. This will insure their remaining in the new hive. The super should also be placed upon the hive at once, as immediately following the swarming experience the bees repair to work with renewed vigor. Aside from the method above mentioned, of cutting off the limb upon which the swarm is clustered, a unique and effectual device for capturing swarms is the "Manum Swarm-catcher," shown in Fig. 23. This consists of a wire basket with a hinged cover, the entire being mounted upon the end of a long pole, supplied with sharp-pointed iron legs attached a few feet above the lower end. The basket is held below the cluster, given a sharp jar

against the limb and the greater portion of the bees are thereby shaken into the basket. The lid is now closed, either by hand or by catching it on a limb, and the swarm catcher stood up in such a manner that the basket is near the point of original clustering. After being allowed to remain here for a few minutes the bees that were not caught inside the basket will cluster on the outside and the entire swarm can then be carried to its new location.

PREVENTION AND CONTROL OF SWARMING.

The control of swarming is closely coupled with the question of surplus honey production. Inasmuch as the honey gathering ability of a colony depends primarily upon the number of individuals in the hive it will be seen that it is of decided advantage to keep all colonies as strong in numbers as possible. Swarming decreases the number of bees in the colony, and could it be entirely prevented would very materially increase the honey production. Where increase is desired it is advisable to allow each colony to cast one swarm a season, and for the beginner we would not advise the attempt to control swarming by any of the numerous methods recommended in the bee journals. None of them are perfect, and considerable loss of time and labor, besides confusion, may result to the inexperienced bee keeper who attempts to solve this problem—which, at the outset, should only be attempted by experienced apiarists. The most practical method yet devised and which is in common practice by many bee keepers in Texas, is known as the "shook-swarm" method. Briefly, this is as follows: When the swarming fever is fairly on, the old hive is removed from its stand and an entirely new hive put in its place containing frames with full sheets of foundation. The super, bees and all, is now taken from the old hive, and placed upon the new. The combs are then taken from the old hive and the bees shaken off in front of the new hive. The queen is also placed in the new hive. The old hive, containing now nothing but brood in all stages and a few bees, is placed in a new location, the entrance narrowed down to a small aperture and left to itself. The bees hatching rapidly in this hive will care for the brood and will rear a queen from the young larvæ, hence at the end of 21 days we will have a complete colony. Instead of allowing the bees to rear a queen, a mature queen or a matured queen cell (a cell in which the queen is nearly ready to emerge) can be given this colony.

It is supposed that the rough handling, shaking and the entering of a new hive in a way satisfies the swarming fever of the bees, and upon this point apparently rests the success of the method. It will also be well to state in this connection that swarming can be to a great extent discouraged by giving an abundance of storage room in the supers at the beginning of the honey flow. The gorging of the hive with honey is one of the things that hastens swarming and is perhaps one of its prime causes.

A great number of methods for preventing swarming will be found in bee journals and books, but none, unless it be the divisible brood chamber, have been found equal to the shook swarm method described above. The "divisible brood chamber" method, which depends upon the manipulation of the brood nest during swarming time, promises to be

successful, but has not as yet been extensively tested, and in any event is only adapted to the expert bee keeper who thoroughly understands at all times the conditions prevailing within the hive. Where natural swarming is allowed by the bee keeper, several plans have been resorted to with success to prevent the issuing swarms from leaving the apiary. Among these we will mention: clipping the wings of the old queen, the Alley drone and queen trap, and entrance guards. At the approach of swarming time the queen in each hive may be caught and the outer portion of the wing on one side clipped off, care being taken not to cut too close to the body. The queen should always be picked up by the wings or thorax from the combs, whether for clipping or not, and never handled by the abodmen. In clipping the wings hold the queen between the thumb and forefinger of the left hand, grasping her by the thorax. The outer portion of the wing can now be clipped off with a small pair of scissors, and the queen gently replaced upon the comb. In the absence of scissors the wing can be taken off with the blade of a sharp pocket

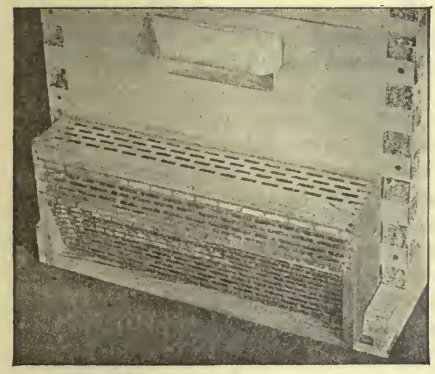


Fig. 24. Alley queen and drone trap. (After A. I. Root Co.)

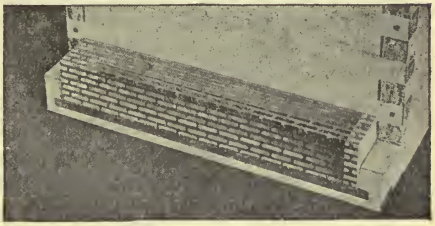


Fig. 25.—Entrance guard. (After A. I. Root Co.

knife, by so holding the queen that the wing to be clipped lies flat and even upon some wooden surface, as upon the top of the hive, and the blade of the knife pressed down upon it. When a swarm emerges from a colony having a clipped queen, the queen will, of course, attempt to follow, but being unable to fly will fall in front of the entrance or near it, where she can be readily picked up by the apiarist. The swarm may remain flying in the air for some time, usually long enough for the apiarist to remove the old hive and substitute a new one in its place. The swarm finding its queen missing will return to the old stand and enter the new hive placed to receive it. While the swarm is entering, the old queen is released and allowed to enter with them. The old hive containing its brood, swarm and young queen or queen cell is placed on a new stand. The device shown in Fig. 24, known as the Alley drone and queen trap, is used in much the same way. As will be noticed from the figure, this trap exactly fits over the entrance to a hive, and no bees can enter or leave without passing through the oblong openings in the perforated zinc of which the trap is made. These openings are of such a size that workers may pass through readily but neither drones nor

queens can pass at all. Above the lower part of the trap is a separate compartment, having openings leading into it from below, large enough to admit queen or drones, and covered with a cone of wire netting. The queen, in attempting to escape from the hive with the emerging swarm, finding herself unable to pass through the smaller openings, passes into the upper compartment and is trapped. The trap and all can now be removed by the apiarist. The old hive is removed and a new located in its place as before, and when the swarm returns the queen is released from the trap and allowed to enter with them. This same device is also used for catching the drones from a colony where they are no longer needed for fertilizing queens, or where the drones come of stock which we do not wish to mate with select queens. The entrance guard, shown in Fig. 25, is used in a similar way, except that it will not trap either drones or queens, although it will prevent them leaving the hive. This is especially useful to prevent the flying of drones from undesirable colonies when the mating of young queens is in process.

In former years "artificial swarming," or "division," was frequently resorted to as a method of increase. Except in the hands of an experienced manager, and where rapid increase is the only thing desired, this should not be undertaken. Among experienced bee keepers it is not now generally practiced.

QUEEN REARING.

Queen rearing is a highly specialized branch of the industry, and in a bulletin like the present it is not deemed advisable to give the methods in use. The average bee keeper should know, however, what to do in case any of his colonies become queenless, through careless handling, accident, or otherwise. When a colony becomes queenless and there are any eggs or very young larvæ in the hive they will rear a queen themselves without further intervention. If, however, they are "hopelessly queenless," that is, have neither brood, eggs nor queen, they can be given a frame of young brood from another colony, when they will proceed as before to rear a queen. In preference to the above, the bee keeper may also purchase a queen from some of the queen breeders who make a specialty of rearing them. Under present conditions, and considering the cheapness of queens, it will not pay the amateur bee keeper to rear queens of his own. They can be purchased at about the following prices: untested, $0.65 to $1.00; tested, $0.85 to $1.50, according to the season of the year. An "untested" queen is one which has been fertilized and has already deposited eggs, but which has not been kept sufficiently long to see that her bees, when matured, prove that she was mated to a drone of the same race as herself. A "tested" queen is one that is not only known to be mated, but is positively known to be purely mated; that is, to a drone of her own race. To distinguish these from a queen that has not been mated, the latter is designated as a "virgin queen." The bee keeper who wishes to study queen rearing in detail, with a view to rearing his own queens, should consult some of the text-books upon bee culture, all of which discuss queen rearing methods, and one in particular—"Scientific Queen Rearing," by G. M. Doolittle—is devoted entirely to the subject. That the bee keeper may know where first-class queens may be obtained, we append herewith a list of those queen breed-

ers in Texas whose stock we have found to be fully as represented and to be commended for its purity: W. O. Victor, Wharton; Hyde Bee Co., Floresville; W. H. Laws, Beeville; G. F. Davidson & Sons, Floresville.

By consulting the advertisements in the various bee journals, the beginner will find the addresses of queen breeders throughout the country, together with the races and strains of which they make a specialty. Except in rare cases queen breeders are found reliable. The fact that the continuance of their business depends entirely upon the purity of the queens they ship, as well as that fortunately none of the bee journals will knowingly accept an advertisement from a suspicious party, makes it impossible for a fraudulent queen breeder to remain long before the people. The fact that queen breeding under present conditions is not an immensely profitable occupation offers little inducement to the swindler.

ENEMIES.

Foul Brood.—Fortunately, in Texas, very little trouble has been had with diseases of bees. Recently, however, a number of very severe cases of foul brood have made their appearance at different points. Foul brood is characterized by the death of the larvæ before reaching maturity, and their decay within the cells. Shortly after death the larvæ turn dark-brown in color, and if a toothpick or other sharp-pointed object be inserted into the body of a dead larva, twisted about, and slowly withdrawn, the mass will be seen to assume a stringy or ropy nature. This "ropiness" is a diagnostic character of the disease, as is also the foul odor affecting a hive thus infected. The bees are evidently unwilling or unable to remove the decayed remains of the larvæ, and these after a time become dry and present the appearance of small bits of a coffee-colored substance in the bottoms of the cells. Upon the death and decay of sealed larvæ, the cappings become sunken and frequently perforated with one or more openings in each cap. This appearance, while characteristic, is not a certain indication of the disease. The test of "ropiness" should be relied upon as the main evidence, with sunken caps, perforated caps, and the foud odor as secondary and confirmatory characters.

Foul brood was first carefully investigated by Watson-Cheyne and Cheshire in London, England. They found the disease to be caused by a specific germ to which they gave the name *Bacillus alvei.* These germs obtain access to the larvæ or food media by which they are surrounded and there multiply with enormous rapidity. It appears evident that they attack directly the tissues of the larvæ, as in all diseased larvæ, dead and decayed larvæ, and in the dried-up masses resulting, the *Bacillus alvei* is found. In honey which has been stored by the bees in cells containing the dried-up masses, the germs are found also, and perhaps to a greater or lesser extent in all unsealed honey in the hive, as well as any honey sealed after the disease enterd the colony. Upon the approach of unfavorable conditions or lack of food supply, the germs assume the spore or resting stage, in which they take no nutriment, do not increase in numbers, and show a marked resistance to heat, extreme cold, and chemicals and disinfectants of all kinds.

Dr. Wm. R. Howard, of Fort Worth, Texas, carefully investigated the pathological nature of foul brood, and in 1894 his results were published in a pamphlet entitled "Foul Brood," by Geo. W. York & Co., of Chicago, Ill. In his investigations, Dr. Howard found that when *Bacillus alvei* or its spores were excluded from oxygen or air they would retain their vitality indefinitely. He also found that *direct* exposure to air for 48 hours or more would destroy the spores. It does not follow from this, however, that exposure of infected hives, frames, etc., to the air, would result in killing all spores. It must be borne in mind that these spores are infinitely small and that the wax, propolis, and other matter adhering to the hive is sufficient to protect these spores from the air, and thus their vitality—and ability to reproduce the disease—may be retained for a long time. It is evident, then, that the exposure of such infected hives, appliances, etc., to the air with a view to disinfecting them, is not to be recommended and must be dismissed as impracticable. Dr. Howard found also that boiling for 45 minutes, or exposure to a temperature of nearly 212° F. did not always kill the spores. An hour or more of boiling was sufficient to destroy them. It therefore follows that boiling for more than an hour, any appliance or hive, care being taken that it is entirely submerged beneath the boiling water, should thoroughly rid it of all germs and spores.

Honey could be disinfected in this way, but is open to the objection that boiling of honey would doubtless impair its flavor. The certain and invincible remedy for foul brood is the killing and burning of all infected colonies, together with the burning or *thorough* disinfection of all infected appliances. In case there are but a few colonies in a locality where bees are abundant, no other remedy should be attempted.

Mr. Wm. McEvoy, of Woodburn, Ontario, Canada, has used extensively what is termed the M'Voy or "starvation" treatment. This has been found successful—according to published reports—by many bee keepers, and we quote from Mr. McEvoy ("A, B, C of Bee Culture," p. 153) as follows:

"In the honey season, when the bees are gathering freely, remove the combs *in the evening* and shake the bees into their own hive; give them frames with foundation starters on and let them build comb for four days. The bees will make the starters into comb during the four days, and store the diseased honey in them, which they took from the old comb. Then in the evening of the fourth day take out the new combs and give them comb foundation to work out, and then the cure will be complete." Personally, we have not had the opportunity of testing this treatment, hence refrain from comments concerning it.

Upon the resistance of the spores, upon many of the pathological characters of the disease, the manner of spread, and upon many other points, authorities disagree. Many points, essential to the successful control of this disease, are unknown, and there is a great need for careful scientific investigation of this dreaded scourge.

The United States census for 1900 (U. S. Census Bulletin, No. 229) gives the total number of colonies in Texas for that year as 392,644. Estimated at $3.50 per colony, their value is seen to be $1,374,254. The amount invested in honey-houses and other apparatus connected with bee keeping, exclusive of hives, will doubtless approximate 5 per cent. of this amount, or $68,712 more. The State Bee Keepers' Statistics,

as compiled by Prof. F. W. Mally, show that in 1900, 150,000 colonies under Texas conditions produced 11,250,000 pounds of honey, or an average of 75 pounds each. For all the colonies in the State, this would without doubt be too high an average. Thirty pounds per colony would seem a conservative estimate. This makes the production of the 392,644 colonies 11,779,320 pounds, which, at an average price of 6 cents per pound, aggregates $706,759.20. Also, about $3,500 worth of queens are annually raised and shipped from Texas. No estimate of the wax produced, or colonies shipped from Texas, is given, but these obviously amount to considerable. Summing up, we have the total capital invested, and annual output of the bee-keeping industry in Texas:

Bees	$1,374,254 00
Appliances	68,712 00
Honey	706,759 20
Queens	3,500 00
Total	$2,153,225 20

These figures serve to show the importance of the industry, which has been rapidly developing within the past few years, and great developments are possible, and probable, in the future. However, foul brood has broken out at three different points, widely separated, and at present this disease threatens the greater part of the honey producing territory of the State. There is no doubt that its presence will tend to restrain further outlay of capital, and the immigration of bee keepers from the older States. To eradicate foul brood will, owing to its contagious nature, and marked resistance to remedies, require suitable legislation. Its eradication is possible under efficient management of capable officials, who are invested with proper authority. Popular education alone cannot establish even a doubtful control of the disease.

Other Diseases.—Black brood closely resembles foul brood in some respects, but may be distinguished from the latter by the fact that black brood is not nearly so "ropy," and has not the odor characteristic of foul brood. Black brood and pickled brood are not of sufficient occurrence in the State to warrant discussion here.

Bee Paralysis is of occasional occurrence, and slight attacks have been reported by a few bee keepers. No case has yet come to our notice, however, in which the damage has been of a serious nature. Bees affected by the disease are characterized by swollen and darkened abdomens, and according to Mr. A. I. Root, of a trembling and nervous nature, with inability to maintain full control of their muscles, ultimately dying. Though supposed to be of bacterial origin, little is known regarding the disease, and upon the foregoing supposition a strict isolation of all colonies affected should be practiced. According to Mr. A. I. Root, also, removing the queen from the infected colony and substituting one from healthy stock has at times proven successful. Moving the infected colony onto a stand occupied by a healthy colony, and in turn placing the healthy colony on the stand occupied by the infected one, is also recommended.

Ants.—Ants of various kinds, and especially of the smaller species, sometimes attack the hives with a view to carrying off the honey and sometimes even build their own nests in the combs of weak colonies.

Strong colonies invariably protect themselves from the first attack, but at times assistance must be given the bees. Where this is necessary the hive should be protected from them. This may be done by placing the hive on a bench or stand, the legs of which have been treated with tar, machine oil, or with crude petroleum (the latter popularly known as Beaumont oil). If the hive-stand shown in Fig. 10 is used, it can be raised slightly from the ground and a couple of pieces of 2x4 inserted beneath it crossways. At the points of contact of the stand with the cross-pieces a small amount of tar or oil should be placed to prevent the ants passing these, the only accessible points, into the hive. The progressive bee keeper will, of course, see to it that weeds and grass are not allowed to grow close enough to the hives to afford passage ways for the ants.

Other Insects.—By far the most destructive enemy of bees in Texas is the wax-moth, of which there are evidently at least two species. In habits, however, they are essentially alike. The eggs are deposited by the adult moth in empty combs, stored honey, bits of wax, and in the case of weak colonies very frequently in the hive itself. Especially is the latter true in the case of box hives. The egg hatches to a cylindrical, grayish-white larva, which feeds upon the comb and wax, usually making a webbed passage along its path of feeding. Especially are they liable to attack stored combs and baits, unless these be placed in practically air tight receptacles. Even then they should be examined from time to time to detect the first possible attack of the moth larvæ. In stored comb the larvæ can be killed by fumigation with carbon bi-sulphide ("high-life"). Supers or hive bodies containing the combs to be treated are piled one above another, being made as nearly air-tight as possible. Indeed, for complete success with this method all cracks and crevices must be thoroughly closed. A saucer containing a few tablespoonfuls of the bi-sulphide is now placed on *top* of the highest row of frames and the entire closed over with a heavy blanket, and allowed to remain for several hours. It should be borne in mind that the carbon bi-sulphide is highly inflammable, and under some conditions explosive, hence care must be taken in its use and handling to avoid proximity to fire of any kind, lighted lamps, lanterns, pipes, stoves, etc. A better plan during summer, when combs are found to be infested is to place them over a *strong* colony of bees, and the latter will make quick work of the moth larvæ. In short, this is the best place to keep such combs, supers, etc., at all times. Strong colonies, in good frame hives, are rarely if ever attacked by the wax-moth. The intelligent and progressive bee keeper who uses up-to-date methods has nothing to fear from this pest. The destructiveness of this pest is mentioned in the introduction to this bulletin on a previous page, which see.

A large species of robber fly of the genus *Erax* sometimes attacks and carries off individual bees. As a usual thing, these are not abundant enough to do great damage.

Birds and Other Enemies.—Very rarely an individual bird, especially the bird known as kingbird or bee-martin, will capture the bees as they fly to and from the hive. This habit is not a universal one with any bird, and is only developed by the individuals. Where the offender persists in his attacks, a shotgun is the best remedy, but in no case should warfare be made upon the birds as a whole, or even upon the kingbirds

as a rule, to atone for the offenses of a single individual. The kingbird is pre-eminently, as are to a great degree all of our song birds, insectivorous, that is, its main diet is made up of worms, larvæ and insects. The good that birds of any species—barring, possibly, the turkey buzzard—do to the farmer, planter and fruit grower far more than offsets the occasional damage. Their protection and preservation is, therefore, to the utmost interest and welfare of the farmer and fruit grower, as well as to the State at large.

Spiders, especially of the larger kinds, will, if allowed, make their webs near or upon the hives and destroy bees. The only remedy here is a constant warfare against them, killing whenever possible, leaving no cracks or crevices for their protection, and persistently removing all webs at fast as they appear.

Fig. 26.—Japanese buckwheat (After Root, A B C of Bee Culture)

HONEY PLANTS.

It is of immense advantage to the bee keeper to carefully study the native honey-yielding plants of his locality, to make careful notes upon their blooming periods, the relation of the season to their blooming, etc. This will enable the intelligent bee keeper to approximately forecast the honey flow, thus enabling him to be fully prepared for it and to get the greatest returns possible. It will also enable him to forecast with reasonable probability the approach of a scarcity or dearth of honey. By the latter he will be enabled to have all colonies strong, and especially will he have them supplied with sufficient stores.

As stated under the head of "Honey Flow," the essential feature of successful surplus production is to have a strong force of bees present in the hive at the beginning of the honey flow. In order that this con-

dition may prevail it is essential—and advisable from many other standpoints—that the force of bees in each colony should be kept as strong as possible *throughout the entire year.* This can, to a certain extent, be accomplished by cultivated honey plants. Among the most useful of these is Japanese buckwheat, shown in Fig. 26, and which is discussed at length in the "Report on the Experimental Apiary," in the first pages of this bulletin.

The bee keeper owning his own farm will find it very profitable to cultivate cowpeas as one of his staple crops. Aside from the fact that this plant yields an abundance of forage even under ordinarily unfavorable conditions of drouth, it is a valuable soil renovator, and will yield honey continuously—sufficient to maintain brood rearing, and to equal the consumption of the colonies, long after the native honey plants have ceased to yield honey.

EDUCATION.

The bee keeper should at all times keep himself thoroughly posted along bee keeping lines. As this industry is comparatively in its infancy, rapid strides are being made in its development. Aside from keeping abreast of the times, the bee keeper can also by judicious study learn much of the industry, methods of manipulation, management, etc., and will furthermore find such study and reading extremely pleasant and fascinating. This may be acomplished in five ways, any or all of which should be taken up.

1. Upon bee culture, there are a number of reliable text-books, adapted to the beginner in about the order named: Root, A. I., "A, B C of Bee Culture"; Maeterlinck, "The Life of the Bee"; Cook, "Manual of the Apiary"; Dadant, "Langstroth on the Honey Bee"; Cheshire, "Anatomy, Physiology and Floral Relations of the Hive Bee"; Morley, "The Honey Makers"; Root, L. C., "Quinby's New Bee Keeping"; and Doolittle, "Scientific Queen Rearing." These books can be secured through any of the dealers or manufacturers of bee supplies.

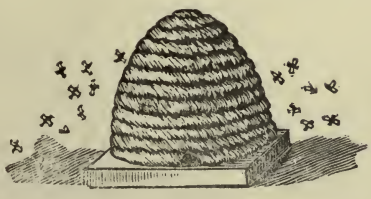
2. The following bee journals, which have thus far come to this department, are worthy of commendation. The names and places of publication are here given: *Gleanings in Bee Culture,* Medina, Ohio; *Rocky Mountain Bee Journal,* Boulder, Colo.; *American Bee Journal,* Chicago, Ill.; *Bee Keepers' Review,* Flint, Mich.; *American Bee Keeper,* Fort Pierce, Fla.; *Progressive Bee Keeper,* Higginsville, Mo.; *Canadian Bee Journal,* Brantford, Canada.

3. Membership in the National and State Bee Keepers' Associations. As holds true with all lines of industry and business, many mutual advantages are to be had by co-operation and unity of purpose. In the case of the Texas bee keepers, this is accomplished in the Texas Bee Keepers' Association, of which any bee keeper can become a member. Aside from representing the importance of the industry as a whole, the Association holds annual meetings, which are exceedingly instructive and are productive of much practical education to the bee keeper. The marked rapidity of advancement in the case of this industry makes it necessary for the bee keeper who would be at the front to keep in touch with the progress made by fellow workers along the same line. The National Bee Keepers' Association has for its objects the protection of

bee keepers and their interests in every part of the United States, regardless of whether the bee keeper be poor or rich. One of the main objects of the National Association is to prevent the adulteration of honey and to promptly prosecute all offenders. It also looks after the individual rights of its members in their relations to other industries, and protects them when unjustly attacked or prosecuted, and in every possible way forwards the interests of the industry. As a membership in the State Association also includes membership in the National Association, besides many other advantages, it will be seen that this should not be neglected. Further particulars regarding these associations can be had by addressing the Secretary of the Texas Bee Keepers' Association, at present Mr. Louis H. Scholl, of Hunter, Texas.

4. Where special problems arise, or where specific information upon any phase is desired, as well as information on honey plants, the Department of Entomology of the Agricultural and Mechanical College, at College Station, Texas, is prepared to give information and answer questions of this kind. All such services are, of course, rendered without charge.

5. At the Agricultural and Mechanical College instruction in Bee Culture is given to students in the Agricultural, Horticultural and Science courses of study. In addition to this, a person desiring to enter the College for the purpose of making a special study of bee keeping is permitted to do so. Every necessary equipment and instructors are provided therefor. Arrangements for such a course can be made by correspondence with the Department of Entomology, College Station, Texas.

SUPPLIES.

The beginner in bee keeping will desire information as to where to secure supplies, etc. By consulting any of the bee journals, advertisements of manufacturers and dealers in such supplies will be found. Catalogues from a few leading firms of this kind should be secured, which, aside from their quotations, usually contain much of an instructive nature, the study of which will be profitable to the bee keeper. Of firms in Texas, we may mention the A. I. Root Co., having a branch supply house at San Antonio, and agents at various points over the State; J. K. Hill & Co., of Uvalde, carry a very complete line of supplies; while W. R. Graham & Son, Greenville, and W. H. White, Blossom, Texas, are manufacturers of hives and other supplies.